MAY 1961

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

A DESIGN ENGINEER'S NOTE BOOK

UNIVERSITY MICROFILMS
313 N FIRST ST
ANN ARBOR MICH

PMM design, finishing and use:

PLASTER MOLD CASTINGS • INVESTMENT CASTINGS
PERMANENT MOLD CASTINGS • DIE CASTINGS
POWDER METALLURGY PARTS • EXTRUSIONS

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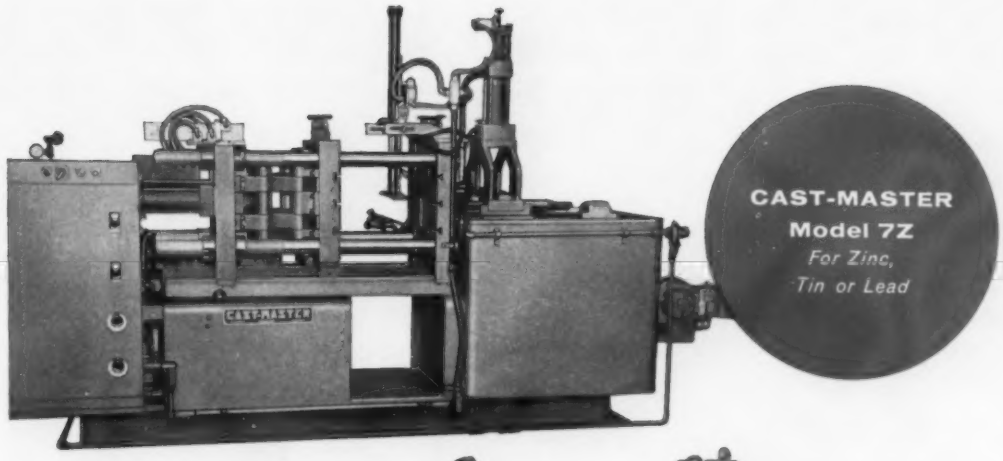

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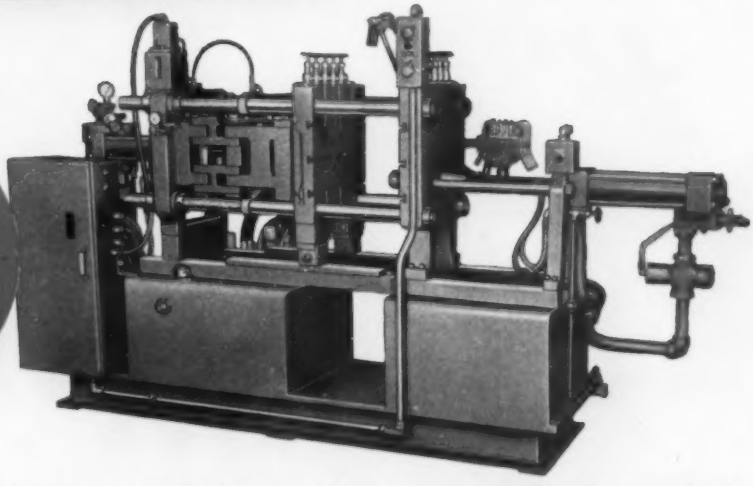

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Model 7A
For Aluminum, Magnesium or Brass

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SPECIFICATIONS

	Model 7Z	Model 7A
Die Locking Pressure	100 tons	100 tons
Distance between rods HxV	13½" x 13½"	13½" x 13½"
Tie rod centers, HxV	16" x 16"	16" x 16"
Tie rod diameter	2½"	2½"
Die mounting plates, TxHxV	3½" x 21½" x 21½"	3½" x 21½" x 21½"
Die thickness	4" min., 19" max.	4" min., 19" max.
Die stroke	4" min., 8" max.	4" min., 8" max.
Shot position	On center or 4" below	3½" below center
Shot cyl. dia.	2½"	3⅝"
Shot cyl. stroke	6½"	11"
Machine size, WxLxH	48" x 120" x 72"	48" x 120" x 58"
Weight, gross	6,900 lbs.	6,400 lbs.

CAST-MASTER Die Casting Machines are engineered for volume production. Here are two of the newest Cast-Master automatic models to be offered to the industry. Both are ruggedly constructed throughout and embody time-tested Cast-Master features that insure reduced maintenance, faster die set-up and maximum safety. You'll find these speedy 100 ton units tops for the production of high quality, dense finish castings.

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May, 1961: Volume 19 Number 5

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33 WHY PRODUCT DESIGNERS SPECIFY DIE CASTINGS

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Because an industrial iron base plate had to be hard, durable and have non-staining properties, a gray iron permanent mold casting was chosen.

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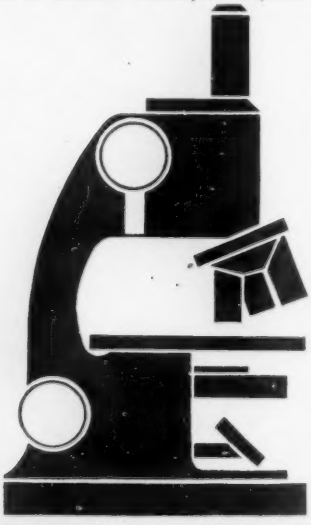

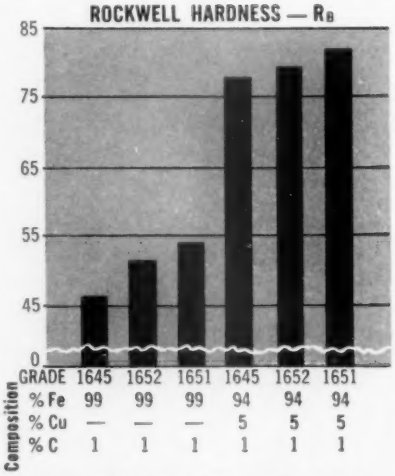

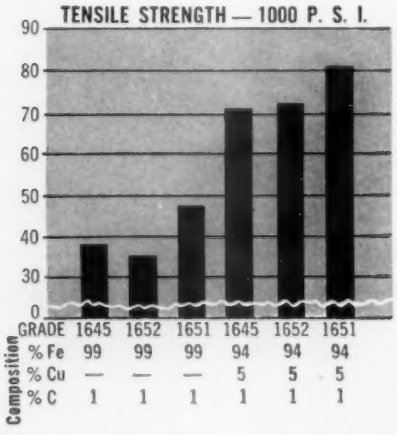

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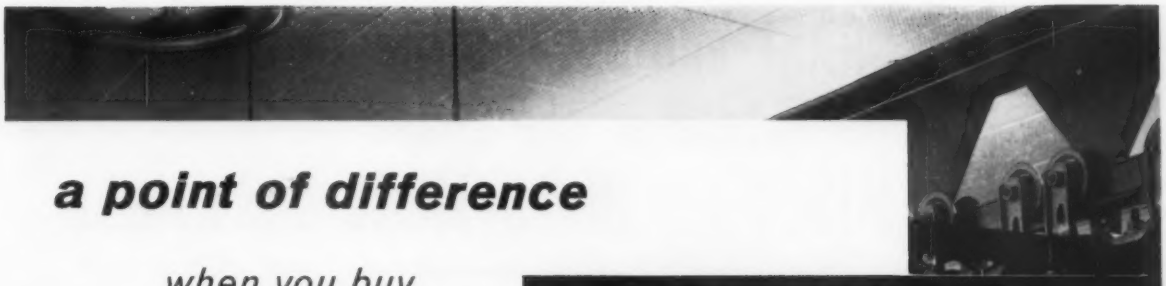

a point of difference

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Details eight control requirements for quality investment castings, major phases for production to meet quality control, process variables and their effect on quality.

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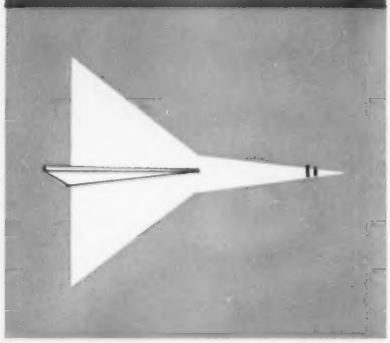
RESEARCH

DEVELOPMENT

PERFORMANCE



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A realistic approach for the product designer

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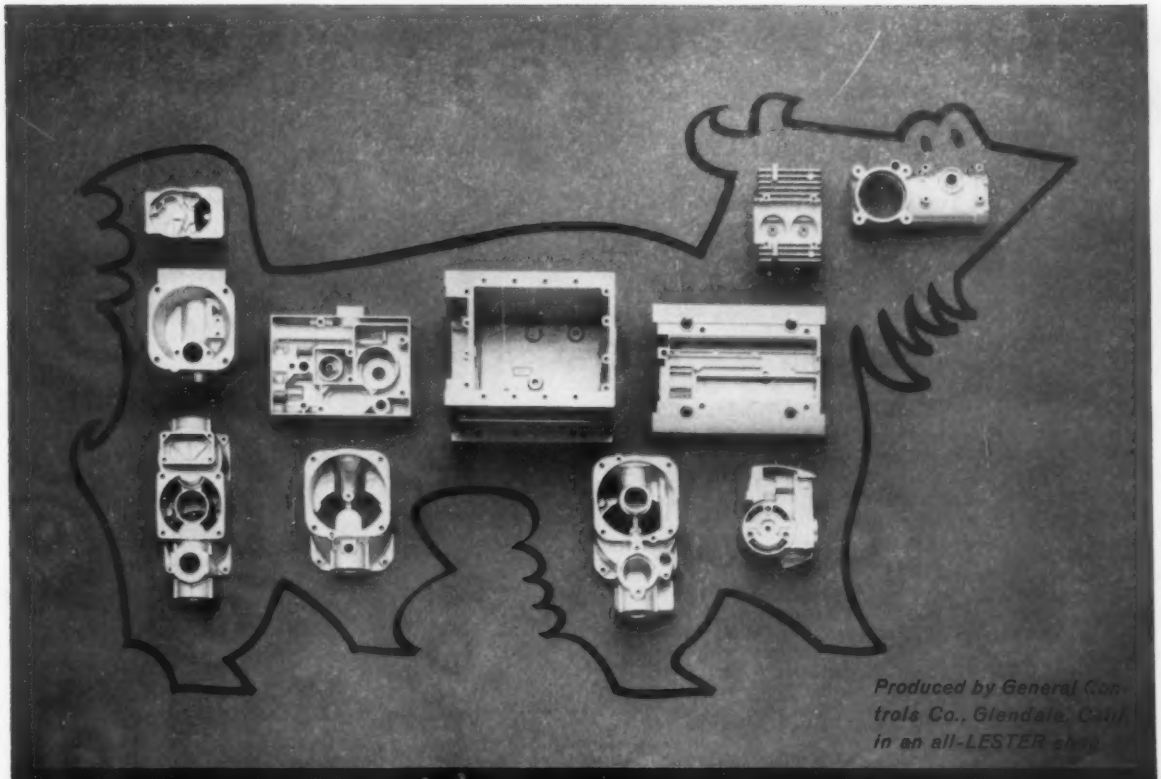

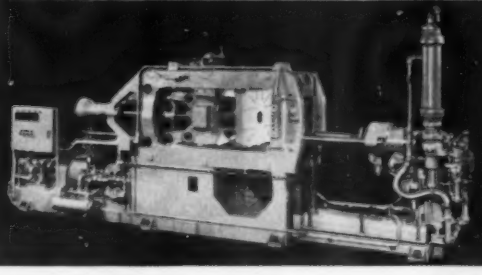

THESE DIE CASTINGS ARE A DIFFERENT BREED OF ANIMAL

The aluminum die castings pictured above may *look like* typical die castings. They are, in fact, a different breed, because they are used to do a job that ordinary die castings *can't* do. As control parts for gas and oil appliances, they must withstand test pressures as high as 300 PSI in some cases. These are PRESSURE-TIGHT CASTINGS!

These die castings are concrete evidence of the special values built into Lester Die Casting Machines. Wilf Botfield, Master Mechanic at General Controls Co. in Glendale, California, where these parts are produced, says: "We couldn't produce this kind of casting except for the absolutely square lock-up of the Lesters. Any flash and the interlocking cores would be plugged solid with metal. And we can't put up with any "normal blow-back"... it would ruin critical dimensions (±.003" to .005"), waste metal and complicate our trimming. For a steady run of flash-free, leakproof parts with the detail and finish we require, nothing beats a Lester."

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LESTER-PHOENIX, INC.
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Agents in principal cities throughout the world

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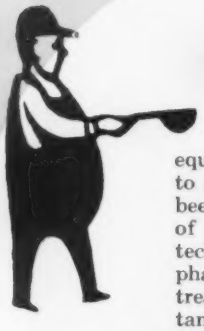
Wherever aluminum needs heat



Meet "Little Joe"! He looks something like a fellow in our plant but we really use him as a symbol of the good right hand of service Lindberg-Fisher's expert design staff and our complete line of "heat for aluminum" equipment is able to render you.

LINDBERG FISHER

You'll find this nameplate on all the equipment you'll need for applying heat to aluminum. Heat and aluminum have been Lindberg's babies for years. Our staff of expert engineers, metallurgists and technicians is widely experienced in all phases of aluminum melting, casting, and treating and has pioneered many important developments in aluminum processing by heat. Today, Lindberg offers you a complete line of heating equipment for every requirement in this field. This includes every needed type of melting, holding or heat treating furnace, large and small, shop built or field erected, fuel fired or electric (resistance, 60 cycle induction, arc or high frequency). We hope you'll let our symbolic friend, "Little Joe", guide you through the exposition of this equipment offered on these pages.

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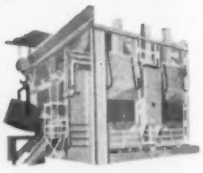
"RIGHT FROM THE START, LINDBERG EQUIPMENT TAKES OVER YOUR ALUMINUM HEATING NEEDS."

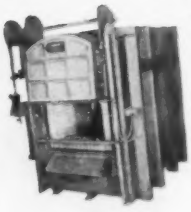


Fuel fired reverberatory. Charging well optional.

"MOLTEN METAL FROM REDUCTION CELLS IS HELD, OR INGOTS MELTED, IN FURNACES LIKE THESE."

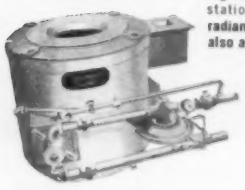
CASTING STATION

"MOLTEN METAL IS HELD AT THE CORRECT TEMPERATURE UNTIL PROCESSED INTO CASTINGS."



Fuel fired reverberatory, holding or melting.

"MANY CASTING STATION FURNACES CAN BE EQUIPPED WITH THE LINDBERG AUTOLADLE, NAMED 'LITTLE JOE', AFTER ME."



Fuel fired crucible or pot, holding or melting, stationary. **New radiant wall type also available.**

Autoladle for automatic ladling, four shot sizes available, up to 100 lbs.

HYNI nitrogen generator, for atmosphere melting and fluxing.

SPECIAL EQUIPMENT

"SOME CASTINGS MAY REQUIRE HEAT TREATMENT AND THESE ARE HANDLED IN THE FURNACES BELOW."

Gas fired billet heater for extrusions.

HEAT

Cyclone heat treating, electric or fuel fired, box or pit.

Cyclone heat treating, electric or fuel fired, box or pit.

60 cycle induction billet heater for extrusions.

"SO, DOWN TO THE FINISHED PRODUCT, LINDBERG EQUIPMENT TAKES CARE OF EVERY STEP."

BILLETS **RODS** **CASTINGS**

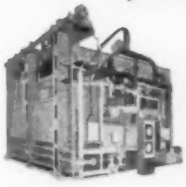
LINDBERG equipment will apply it

Key
Molten Metal
Solid Metal

AND HOLDING FURNACES

Ingot

60 cycle two chamber induction, tilting.



Fuel fired double reverberatory. Especially suitable for alloying. Charging well optional.

60 cycle, two chamber induction, tilting; melting and holding.

MELTING, HOLDING AND REMELT FURNACES

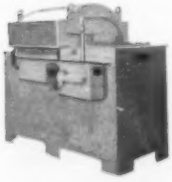
"AS REQUIRED, MOLTEN METAL IS TRANSFERRED TO FURNACES AT THE CASTING STATIONS."

"INGOTS CAN ALSO BE MELTED AND HELD IN THESE FURNACES."

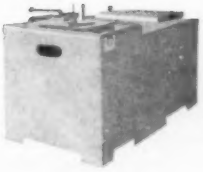
FURNACES

60 cycle induction coreless, tilting, ideal for melting chips.

Fuel fired, crucible or pot, tilting, melting.



Electric resistance, "radiant dome," reverberatory, holding.



60 cycle, two chamber induction, holding or melting, stationary.

Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere.

Electric resistance, crucible or pot, holding or melting, stationary.

Fuel fired, Dry-Hearth, two chamber, holding or melting.

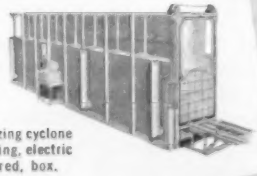
High frequency induction, tilting, melting.

"GATES, RISERS, SCRAP CASTINGS, ETC. GO BACK TO THE FURNACES AT THE RIGHT FOR REMELTING."

Fuel fired, Simplex, rotary, horizontal drum, melting.

"WHY NOT GET IN TOUCH WITH LINDBERG FOR YOUR ALUMINUM HEATING NEEDS? TELL THEM 'LITTLE JOE' SENT YOU."

TREATING FURNACES



Homogenizing cyclone heat treating, electric or fuel fired, box.

D. C. INGOTS

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We'll be glad to discuss your aluminum processing needs with you. Get in touch with your local Lindberg Representative (see your classified phone book) or write us direct.

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LINDBERG ENGINEERING COMPANY

2463 West Hubbard Street, Chicago 12, Illinois

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland, and West Germany.

PMM

casting about *technical news of applications & processes involving precision metal molding*

Titanium Castings Mass Produced By New Process

Titanium Metals Corporation of America has announced a new casting process which permits the mass production of titanium castings. Until now titanium had to be cast in graphite molds which yielded from one to twelve castings per mold. This low yield per mold made titanium castings too costly for most applications.

The new production method, called Impel Casting, is expected to produce about 100 castings per mold. The process requires a titanium electrode, double melted, with molten titanium "impelled" into the die cavity. Titanium's 0.005 in./in. shrinkage rate makes timing a critical factor in feeding the metal and in pulling the cores.

The first commercial order which TMCA is producing by the new process is a twelve pound impeller (photo). The cost of only nine impellers by the new method was lower than the same number of welded assembles now in use.

Because current production is for the chemical industry, where corrosion resistance is more important than strength, unalloyed grades of titanium are being cast. Titanium is practically immune to corrosion in wet chlorine, nitric acid, hypochlorites, urea, and inhibited sulfuric acid environments.

The strength concession is not critical because yield strengths of the castings range from 25,000 to 100,000 psi, depending on which unalloyed grades are used.

Rhenium-Molybdenum Alloys Produced Commercially

The first commercial production of rhenium-molybdenum alloys has been announced by the Chase Brass & Copper Company. This makes improved materials available for use in many aerospace, electronic, and electrical applications at costs much below that of pure rhenium.

Rhenium-molybdenum alloys are high strength, refractory types with good ductility. They have considerable advantages over both pure rhenium and pure molybdenum.

Rhenium is an extremely dense, silver colored metal with a very high melting point (5756°F). It has good strength, ductility, and excellent electrical characteristics, even at high temperatures. The only metal with a higher melting point is tungsten.

Rhenium products have particular application in the electronics and electrical fields. Applications include grids, heaters, and thermocouples.

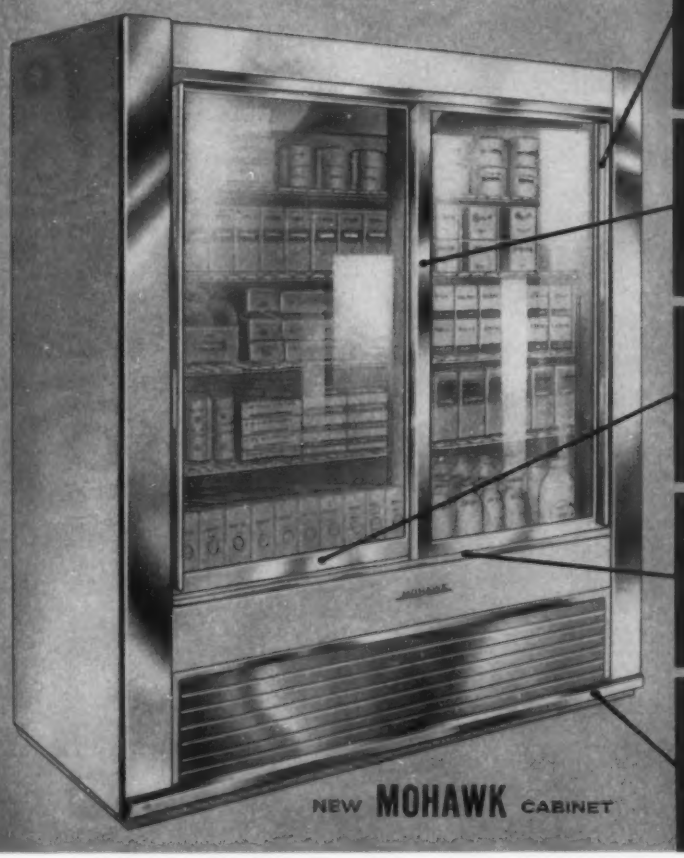
Molybdenum is one of the most widely used high temperature metals. It is used as a structural material in missiles and for electronic tube components. It has a melting point of 4730°F, but becomes embrittled in the recrystallized condition at temperatures below 60°F.

The alloying of rhenium and molybdenum combines the best characteristics of both metals. The alloys have better mechanical properties than either of the pure metals and costs much less than pure rhenium. Elevated temperature strength is better than that of molybdenum. Good ductility is retained down to very low temperatures without evidence of embrittlement.

Rhenium-molybdenum alloys do not become embrittled upon recrystallization as do tungsten and pure molybdenum. Their ductility permits cold or warm forming.

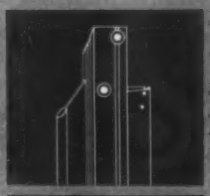
DESIGNING A NEW PRODUCT?

ask Superior about its money-saving aluminum extrusions



CABINET DOOR HANDLE

Extrusion includes rubber bumper adapter, mitered ends, drilled, countersunk, drilled and thread-tapped holes.

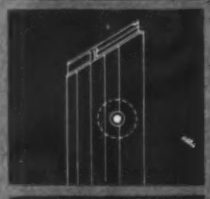


DOOR SLIDE RAIL

45° mitered, drilled, countersunk, polished, chemically brightened and anodized.

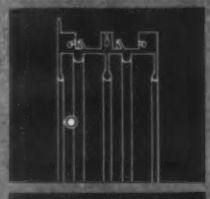
BOTTOM DOOR RAIL

(This section holds a nylon roller wheel.) Mitered, drilled, countersunk and precision thread tapped.



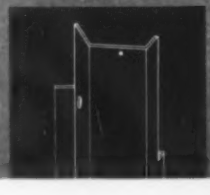
BOTTOM TRACK RAIL

Mitered, milled contours, drilled, countersunk, polished and anodized.



KICK RAIL

Notched, punched, polished, chemically brightened and anodized.



Let Superior show you how you can save money in many ways on your aluminum extrusions. The Mohawk cabinet above is an example of how this leading manufacturer gets extrusions perfectly fabricated from Superior Industries. The extrusions fit perfectly into Mohawk's production line without any further operation. Under one roof, Superior controls the fabricating and refinishing of all these parts, ready for assembly.

In addition to extruding intricate shapes, Superior miters, bends, rivets, drills, countersinks and notches the metal. Chemical and hand polishing, spray painting, anodizing and etching get professional attention. This entire performance saves you labor and factory time. And, thousands of companies have already taken advantage of Superior's complete services.

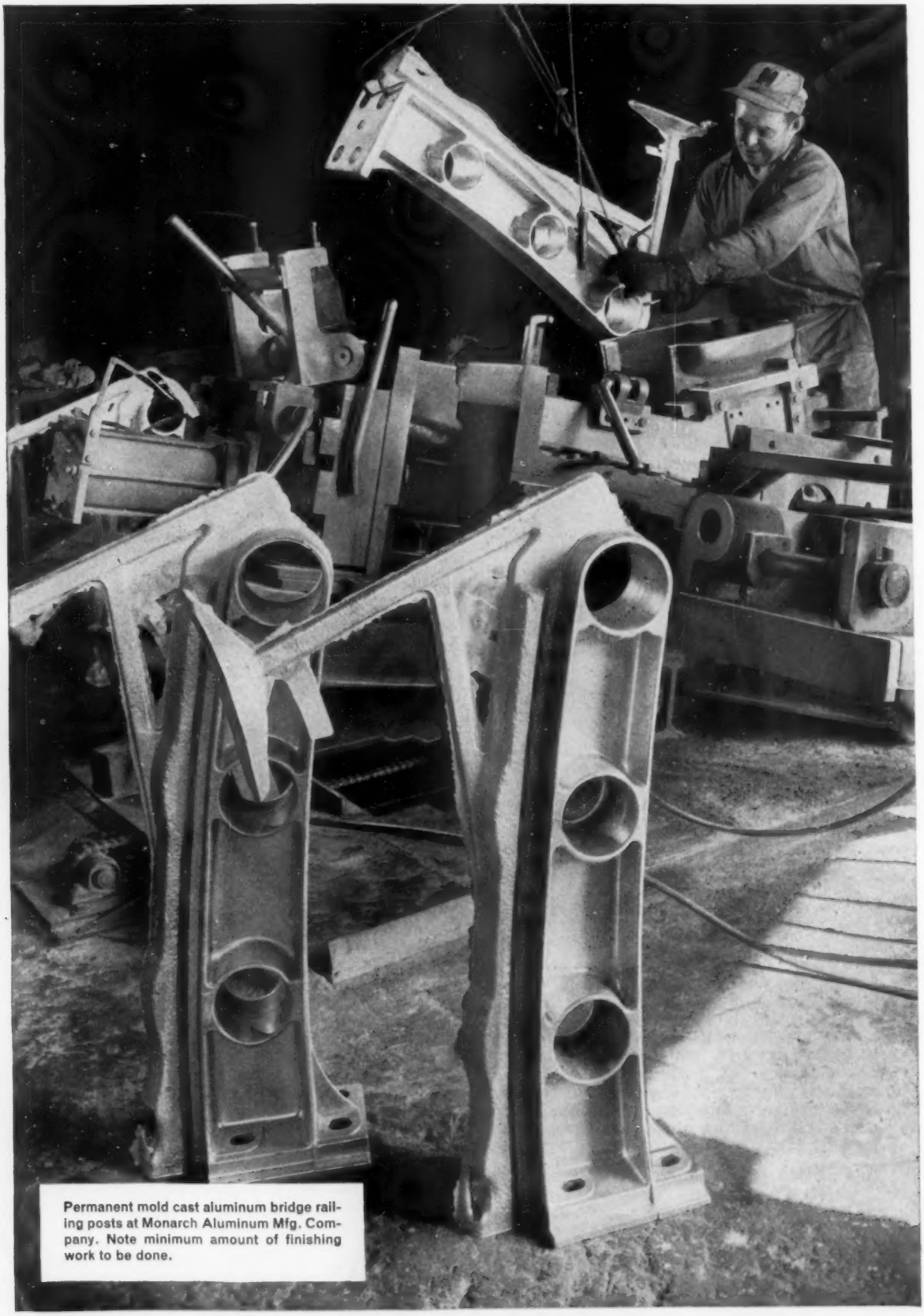
Send us samples, blueprints, or ask us to call. Superior engineers are now ready to help you to save in many ways.

ALUMINUM EXTRUDERS • ANODIZERS • ARTRIM MOULDINGS

SUPERIOR INDUSTRIES INC.

3788 Oakwood Ave.
Youngstown, Ohio

Circle No. **70** on Reader Service Card



Permanent mold cast aluminum bridge railing posts at Monarch Aluminum Mfg. Company. Note minimum amount of finishing work to be done.

product:

BRIDGE RAILING POSTS

production method:

PERMANENT MOLD CASTING

problem:

DUCTILITY

solution:

REYNOLDS ALUMINUM A-356 ALLOY

The Monarch Aluminum Mfg. Company, Cleveland, Ohio, produces over five million castings a year for a wide range of fine products. Here is why Reynolds A-356 alloy is used in one of these products, aluminum bridge railing posts.

"The new Reynolds Aluminum alloy A-356 is more ductile than its predecessor, 356, and therefore even better qualified for production of bridge railing posts," says Mr. R. A. Lawson, Vice-President of Marketing at the Monarch Aluminum Mfg. Company. This job is a natural for the permanent mold casting process where we must meet the rigid highway standards of strength, safety and appearance, and still hold manufacturing costs to a minimum. The availability of Reynolds A-356 with increased ductility opened the door for us to meet the high standards set by the U. S. Bureau of Roads.

"We use many Reynolds Aluminum alloys in our plant, including 13, 43, 355, and B195," Mr. Lawson adds. "In addition to their fine service and the excellent quality of their ingot products, Reynolds has been very helpful to us by making available much valuable marketing and research information, as well as in developing new markets for cast aluminum products."

Reynolds produces many aluminum alloys ideally suited for permanent mold, sand mold and die casting. Excellent mechanical properties, weight savings, good conductivity, workability including machining and finishing savings make aluminum castings attractive for many products. For help in specifying the exact aluminum alloy for your production needs and product use, contact your Reynolds Ingot Distributor. *Or write Reynolds Metals Company, P.O. Box 2346-FP, Richmond 18, Virginia.*

REYNOLDS ALUMINUM

Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV

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Eliminate costly machining with

INVESTMENT CASTINGS

Do your small parts have 4, 5 or more machining operations?
Do they require materials that are difficult to machine?
If so, you should investigate V-R Investment Castings. Machine operations are entirely eliminated, yet intricate details are held to exacting tolerances. You can design for function regardless of shape. Multiple parts are often produced as single units. V-R engineers can develop and cast the proper material to meet the requirements of your application. Send us your specifications today.

COMPLETE DESIGN FREEDOM
without compromise for production limitations.

WIDE CHOICE OF ALLOYS
to meet your requirements for resistance to heat, corrosion and wear.

CLOSE TOLERANCES MAINTAINED
throughout entire production quantity.

EXPERT METALLURGISTS AND ENGINEERS
make recommendations on your application.

PARTS SHOWN
ACTUAL SIZE

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

862 MARKET ST. WAUKEGAN, ILLINOIS

836

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PMM

news of industry & associations *activities of people, companies & groups in the precision metal molding industries*

promotions & changes

Frederic B. Stevens, Inc., Metal Finishing Div.—*James Garland* has been appointed sales representative for western Pennsylvania.

Acheson Colloids Co.—*Roger H. Hendrick* is working with the Applications Development Group in a product development and research capacity.

Package Machinery Co.—*Lyman L. Campbell* has been elected vice-president in charge of engineering.

Dollin Corp.—*Anthony M. Cirelli* has been appointed customer service manager, *John R. Schuchardt* has been appointed as sales engineer to serve the New England area. Schuchardt succeeds *T. R. Foley* who has been assigned to the New York Metropolitan area.

Precision Castings Co.—*Ernest Currie* has been appointed sales manager for sales and service for aluminum and zinc die castings in Illinois, Missouri, Iowa, Minnesota and Wisconsin.

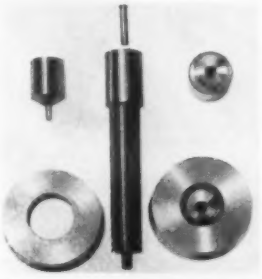
Spincraft, Inc.—*Ralph W. Fink* has been elected vice-president.

Olin Mathieson Chemical Corp.—*J. J. Forst* has been named assistant product manager of the Metals Division's aluminum pig, ingot and billet product department. *G. R. Ballantyne* has been appointed government representative, Metals Division.

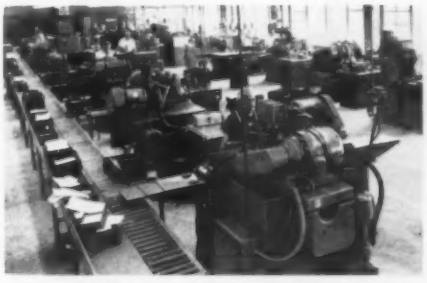
Harcast Co., Inc.—*Mace Associates, Inc.* has been appointed to represent the investment casting company in the South.

more on page 84

Expansion at Stokes' Punch and Die Division completed



IMPACT EXTRUSION punches and dies are produced at the new facilities.



A CONVEYOR is next to automatic turning equipment for faster production, more efficient handling.

F. J. Stokes Corp. recently completed expansion of its facilities in Philadelphia for producing precision dies and punches. The tools are used by customers engaged in compacting metal powders, impact extruding, and other metal-forming operations.

The new facilities make it possible for Stokes' Punch and Die Division to operate as a completely self-contained unit. Such processes as heat treating, hobbing and nitriding are handled internally.

1961 zinc die casting competition is open

The die casting industry's annual award competition is officially under way for 1961. This year the New Jersey Zinc Co. has broadened the scope of its "Zinc Die Casting of The Year Award" by offering a dual grand prize for the casting selected. $500 will go to the die caster and $500 will go to his customer. It will be given to the persons who, in the opinion of their respective employers, have contributed most to the successful design and production of the casting.

Presentation will be made at the annual American Die Casting Institute meeting in Chicago, September 27. Competition closes August 1, 1961. Entry blanks and additional information are available from C. R. Maxon, The New Jersey Zinc Co., 160 Front St., New York 38, N. Y.

more Industry News on page 86

GARLAND

HENDRICK

CAMPBELL

CIRELLI

SCHUCHARDT

CURRIE

National Lead Service and Bunker Hill Metals...

A top name in the metal business paired with top metals . . . to give you what you want when you want it. Service that anticipates your needs . . . metal purity that exceeds your "specs".

Take the gamble out of your metal buying . . . get BUNKER HILL Special High Grade (99.99+%) Zinc and BUNKER HILL Zinc Base Alloys from:

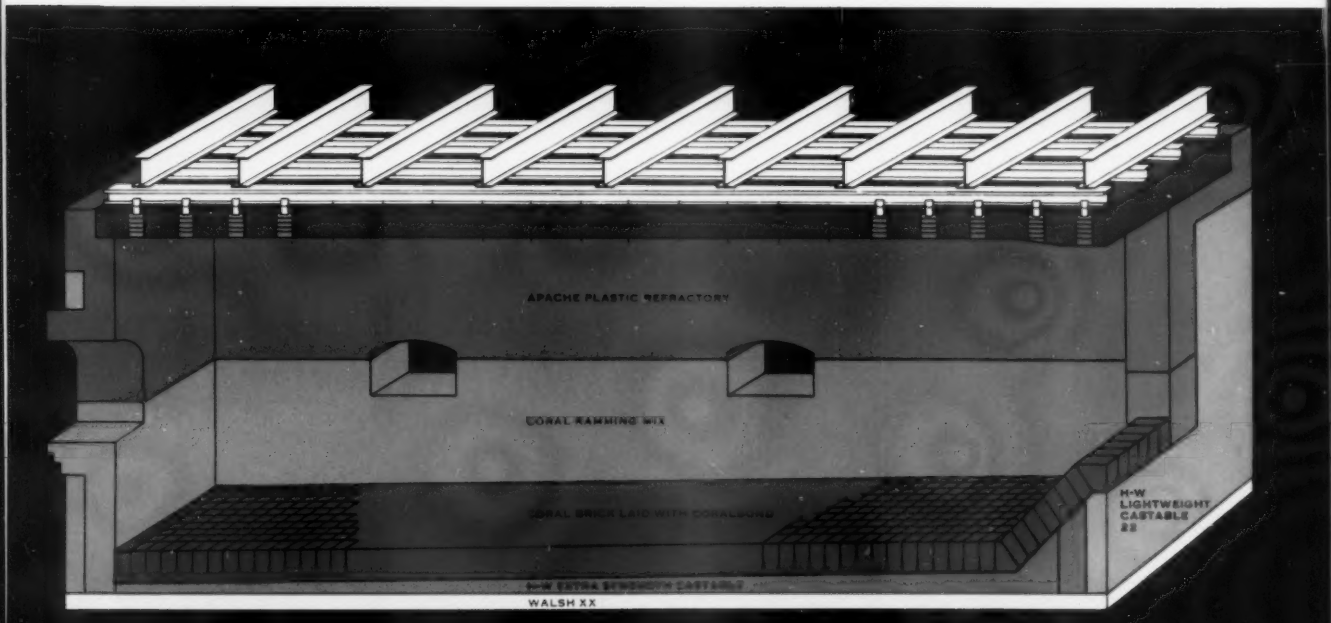
NATIONAL LEAD COMPANY General Offices: 111 Broadway, New York 6, N. Y.
Branches in All Principal Cities

Circle No. 52 on Reader Service Card

THIS HIGHLY SUCCESSFUL ALUMINUM MELTING FURNACE FEATURING MONOLITHIC CONSTRUCTION WAS BUILT ENTIRELY OF HARBISON-WALKER REFRACTORIES.

Construction and product details are given on the following page. PHOTO: COURTESY OLIN-MATHIESON CHEMICAL CORPORATION

CORAL BRICK, CORALBOND AND CORAL RAMMING MIX WERE ESPECIALLY DEVELOPED BY HARBISON-WALKER FOR ALUMINUM MELTING FURNACES. THEY HAVE ALREADY DEMONSTRATED UNUSUAL RESISTANCE TO PENETRATION AND CORROSION BY ALUMINUM ALLOY REACTION . . . AS WELL AS TO THERMAL SHOCK, SPALLING CONDITIONS, AND SEVERE IMPACT AND ABRASION. THE REFRACTORY USED IN EACH FURNACE SECTION WAS SELECTED TO ASSURE THE BEST BALANCED SERVICE LIFE.



WALSH XX

A strong, power pressed, high duty fireclay brick.

H-W EXTRA STRENGTH CASTABLE

A refractory concrete of outstanding physical strength.

CORAL brick, laid with CORALBOND

These specialized high-alumina brick and mortar have exceptional high strength to withstand spalling and slagging influences, and provide remarkable resistance to molten metal reaction.

CORAL RAMMING MIX

This companion product to CORAL brick and CORALBOND, installed by gunning or ramming, has excellent resistance to molten aluminum alloys and develops great strength at operating temperatures.

H-W LIGHTWEIGHT CASTABLE 22

An insulating monolith.

APACHE PLASTIC REFRACTORY

A high alumina (60%) monolith with refractoriness equal to brick of this class but with much lower permeability.

H-W SUPER PLASTIC

A monolith with very good workability and [illegible] ness equal to super-duty brick.

WRITE FOR DATA — Complete product descriptions and test data are available showing the superior resistance of these refractories to aluminum alloy reaction.

HARBISON-WALKER REFRACTORIES COMPANY AND SUBSIDIARIES

GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

HW 61-7

Why the DIE CASTER

talks D-M-E STANDARD UNIT DIES to the Die Designer and Die Maker

Changeover time goes down ...Profits on short runs go up!

Die changes on zinc or aluminum castings which normally take 3 to 5 hours are now done in minutes with D-M-E Standard Unit Dies.

D-M-E Replacement Units are fully interchangeable: Quickly and easily they're taken out and replaced in the Unit Holder . . . production is continued immediately!

Because several jobs can run on one machine, you increase profits on short run jobs. What's more, you get the quality, the performance and the standardization of replacement parts needed for volume production work.

DIE CASTERS, DESIGNERS AND DIE MAKERS GET MORE FROM D-M-E!

• AVAILABILITY: D-M-E Replacement Units are carried in stock at your local D-M-E Branch for quick delivery. • VARIETY: D-M-E Replacement Units are available in your choice of steel and hardness. • UTILITY: D-M-E has a Standard Unit Die to fit your machine, whether you require rack and pinion or automatic "bumper-type" ejection. • FLEXIBILITY: Complete freedom on three sides of the cavity for core or cooling line placement; six leader pins and bushings for accurate alignment; "quick change" wedge clamps for positive plate positioning. • Start increasing profits on your short-run jobs with D-M-E Standard Unit Dies!

Write for your free copy of *Lower Die Cost Through Standardization.*

61-A-DC

DME **DETROIT MOLD ENGINEERING COMPANY**

6686 E. McNichols Road — Detroit 12, Michigan — TWinbrook 1-1300

Chicago • Hillside, N. J. • Los Angeles • D-M-E Corp., Cleveland, Dayton
D-M-E of Canada, Inc., Toronto

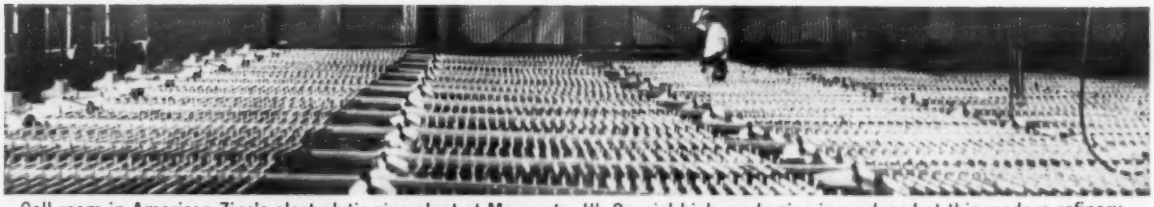
Injection and Compression Mold Bases • Injection Unit Molds • Cavity Retainer Sets • Mold Plates • Ejector and Core Pins
Ejector Sleeves • Leader Pins and Bushings • Sprue Bushings • Moldmakers' Tools and Supplies

Circle No. **21** on Reader Service Card

INTEGRATED PRODUCTION—from Ore to Ingot

Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of



Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

AZCO Zinc Die Cast Alloys

Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company

1515 Paul Brown Building, St. Louis 1, Missouri

Distributors for:

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Detroit • Columbus, O. • Chicago • St. Louis • New York

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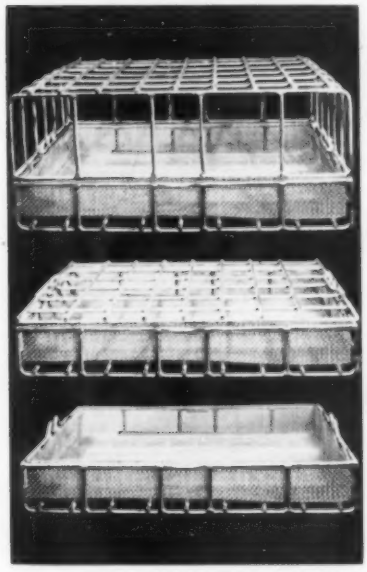
PMM

new products & developments *qualified readers can get complete details on these products. Use the reader service cards.*

Grids lock in place for heat treating

ISPEN INDUSTRIES, INC.—Long pieces or special shaped materials are held by special grids during heat treating operations. The special grids are used with a standard line of heat treat baskets in controlled atmosphere heat treat furnaces and vacuum heat treat units.



The grids are made of high heat resistant materials. They maintain strength under extreme temperature changes and resist atmosphere contamination.

Circle No. **236** on Reader Service Card

New fabric filters molten aluminum

J. P. STEVENS & CO., INC.—Superflow is a fiber glass fabric used to filter impurities from molten metals, especially aluminum. The fabric is made on the high twist yarn principle to increase the number of interstices and thereby increase metal flow rates substantially.

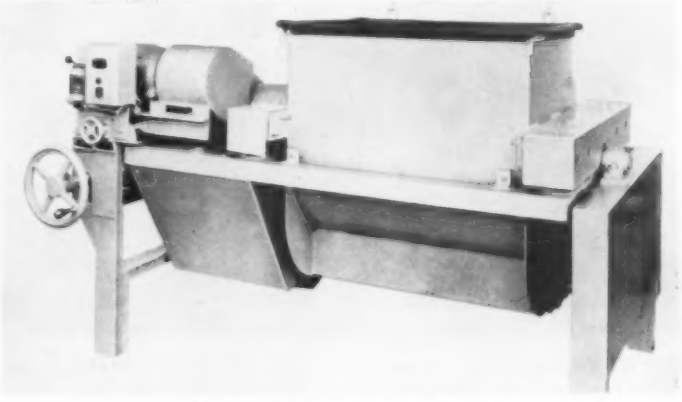
Fabrics are relatively less expensive than alloy steel screens that require periodical cleaning.

Molten aluminum in a billet casting machine (see illustration) is being filtered through the Superflow fabric.

Circle No. **235** on Reader Service Card

Get a finer finish with a rubber mounted vibrator

MINNESOTA MINING AND MANUFACTURING CO.—With a new rubber mounted Vibrahone finishing tub, parts get a finer finish and the machine has a long service life. Rubber mounts, instead of springs, and an exclusive drive principle retain more than 98% of the generated vibrating force inside the tub. Service life is extended because frame and floor vibration is negligible. The suspension and drive system also lowers operating costs. The rubber lined tub is detachable and tilts for easy draining.

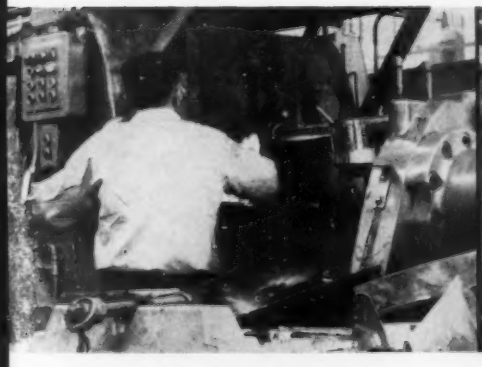


Circle No. **237** on Reader Service Card

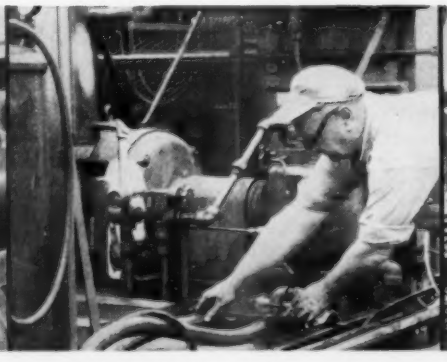
more New Products on page 65

PREVENTIVE MAINTENANCE with PYDRAUL®

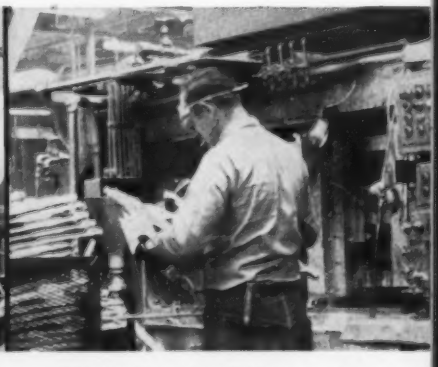
Electronic nerve center of Singer's mile-and-a-half-long conveyor system at Elizabethport, N. J.



PREVENT HAZARDS. Singer worker pours molten aluminum into a die-casting machine. There's no danger of flash fire or explosion even if a sudden hydraulic line break sprayed Pydraul fluid on hot metal or an open switch.



PREVENT HIGH UPKEEP. At Singer the hydraulic systems are filtered while the die-casting machines keep operating. The Pydraul fluid stays clear and clean. No corrosion. No drainage.



PREVENT DOWN-TIME. Singer's sixteen massive Lester-Phoenix die-casting machines must work around the clock to produce parts for 10,000 family sewing machines each week. Down-time can't be tolerated. Pydraul fluid helps prevent it.

The Singer Manufacturing Company speeds output, cuts upkeep time 75%

PROBLEM: 24-hour production, to meet demand for Singer's new Series 400 family sewing machines, made elimination of down-time *imperative.* Water-glycol hydraulic fluid in Singer's die-casting machines provided fire resistance . . . but the upkeep was formidable. Frequent pump and valve failure, rust, and sludge clogging were critical.

SOLUTION: Change-over to PYDRAUL A-200 fluid. Now, Singer's die-casting systems are filtered *while operating full blast.* Hydraulic systems stay clear and clean. No sludge, no rust, no wasted fluid.

RESULT: (1) greatly reduced down-time losses; (2) no valve replacements; (3) *total maintenance time cut 75%* . . . despite the fact that Singer now operates twice as many die-casting machines as before!

Says Al Schaefer, manager of Singer's Elizabethport, N. J., die-casting department: *"These operating economies are a direct result of our change to PYDRAUL A-200 fluid. In fact, the change not only solved rough maintenance problems but the permanence of PYDRAUL cut direct costs, too. This fluid doesn't evaporate. We don't have to drain it. And I think it gives us 100% better lubrication than the water-based fluid. No worry about fire, either."*

PYDRAUL fluids are straight synthetics—*chemically* compounded from fire-resistant materials; won't flash or flame after contact with hot ignition sources—*not even when sprayed through a 6,000° F. oxyacetylene torch flame* (AMS-3150B and MIL-F-7100 high-pressure ignition tests). PYDRAUL fluids contain no water to evaporate or corrode metal . . . or throw your machine out of whack by rapid build-up in viscosity. Lubricity rivals the finest petroleum oils. PYDRAUL fluids perform well under line pressures up to 5,000 psi, at temperatures up to 300°F.

COMPARE VITAL PROPERTIES	PYDRAUL	Water-Glycol Fluid
Lubricity under heavy loads	Excellent	Fair
Oxidative stability	Excellent	Poor
Thermal stability	Excellent	Poor
Vapor pressure	Very low	High
Foaming resistance	Excellent	Fair
Oil compatibility	Excellent	Poor
FIRE RESISTANCE	Excellent	Excellent*

*provided water has not evaporated!

PYDRAUL fluids provide the *safety* you desire . . . plus the *performance* you need. You owe it to yourself (and your workers) to get the complete facts on fire-resistant PYDRAUL fluids. Mail the handy coupon today.

PYDRAUL SAFEGUARDS die-casting machines • hydraulic presses • furnace tilters • mold casters • stampers • extrusion presses • ingot loaders • injection molding machines • forging presses. **Over 500 million machine hours' service proves PYDRAUL performance!**

Monsanto®

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Industrial Fluids Dept. 4425-S
St. Louis 66, Missouri

Please send me these new bulletins:
☐ "Know Your Fire Hazards"
☐ "Preventive Maintenance in Fire-Resistant Hydraulics"

*Name*_____
*Company*_____
*Street*_____
*City*_____ *Zone*____ *State*_____

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THE FREEDOM DIMENSION

. . . means alloy flexibility

Through investment casting, your metal parts can be made in a wide range of ferrous, nonferrous and super alloys. Results — better performance...longer life...lower costs!

This part for can making machinery now cast in a non-machinable alloy offers a very high degree of resistance to wear and corrosion. Results — costly parts replacement problems ended.

Better alloys often cost no more than the "inexpensive" ones when your part is an investment casting. What counts is *castability*, not machinability.

Write for complete technical and facilities information.

HITCHINER
Milford 2, New Hampshire

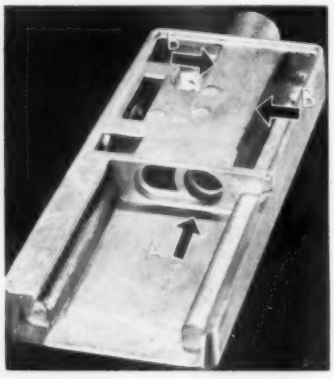
Circle No. **32** on Reader Service Card

PMM letters

the readers' forum

LEAKER

We have a problem with one of our aluminum die castings. A blind circular hole about 2" deep runs through metal having channels on both sides. There is porosity along the edges formed where the top surface meets the



side walls of the channels. Under 100 psi pressure, air leaks from the hole through the porosity. Can you suggest ways to make the hole carry this pressure without leaking?—E. G., Chief Engineer.

The casting to which this reader is referring is shown above. The hole which carries the pressure is marked "A". The edges which leak are marked "B". The casting is roughly 2" x 4". We suggest considering vacuum casting or impregnation, or reviewing alloy selection and gating. PMM would like to hear from readers who have suggestions regarding this problem.—Ed.

SCHMIDT PROCESS

We are interested in the low pressure casting process de-

Continued on page 26

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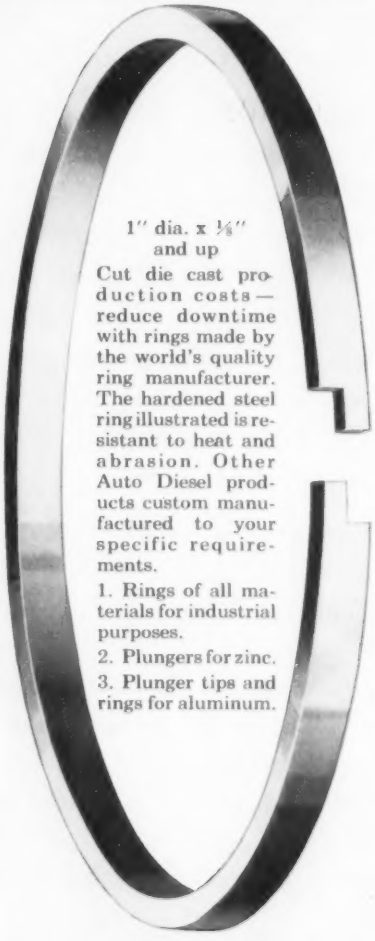

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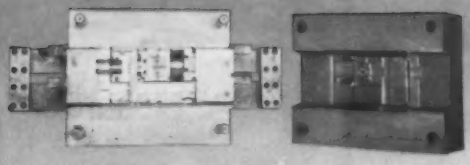

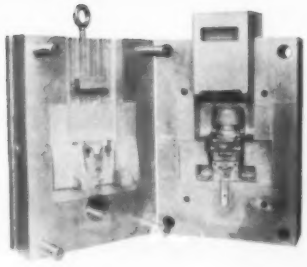

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letters

scribed in recent issues of PMM. This is the casting process developed by Karl Schmidt of Frankfurt, Germany.

The German Consulate here in Sydney, Australia has not been able to give us the address of the sponsor of this casting process. We were hoping you could put us in touch with an American source, or give us the postal address of Karl Schmidt. –G.R., General Manager

We are sorry that we don't know the name of the parent German company holding patents on the Schmidt Process of casting. Ladd & Little, Inc., 570 Walt Whitmann Road, Huntington Station, Long Island, New York, are North American licensees for this process.–Ed.

SHAW PROCESS

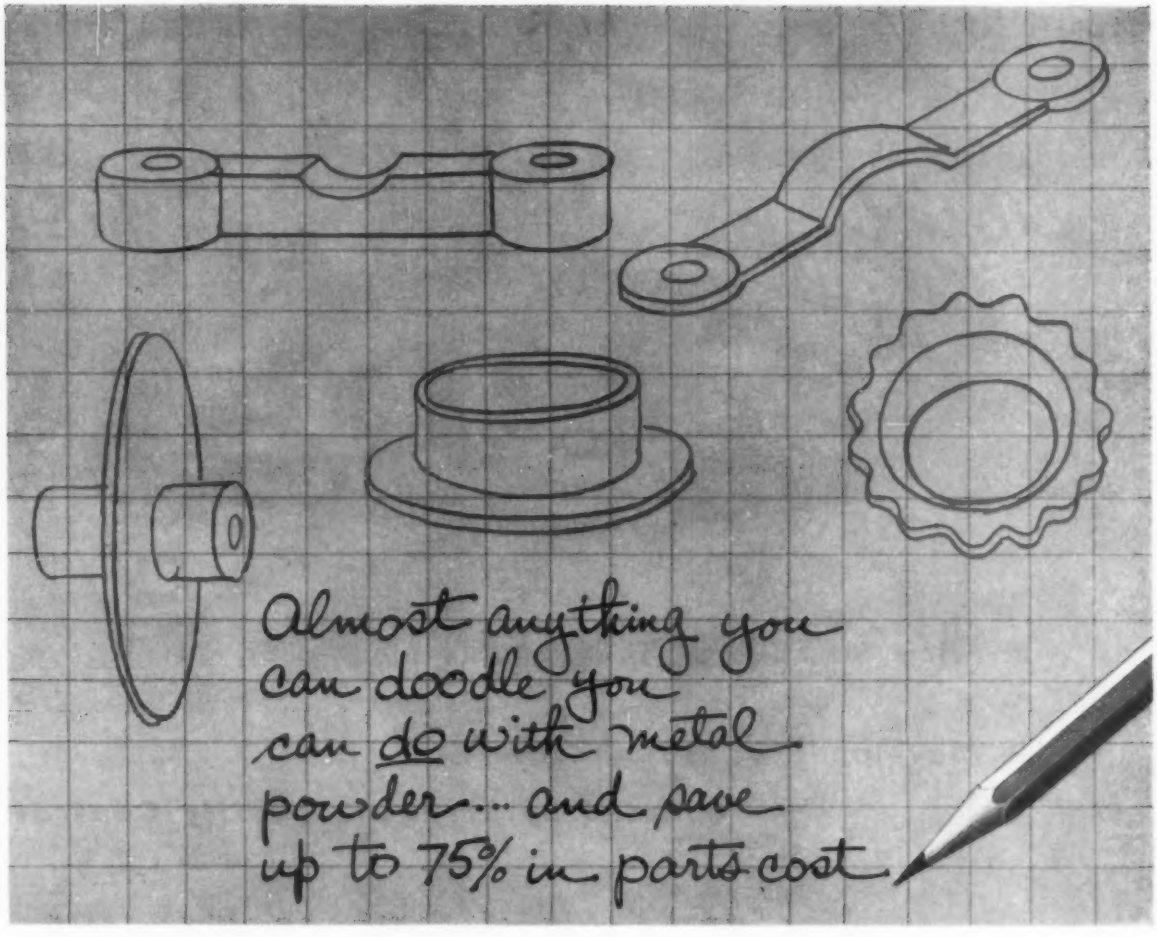
I wonder if you would be able to help us locate literature and sources of supply near Jersey City, N.J. for castings produced by the British "Shaw Process."–G.W.F. Purchasing Department.

The British Industries Corporation, 80 Shore Road, Port Washington, Long Island, New York, is the best source of information on available castings and licensing under the Shaw Process.–Ed.

IMPACT EXTRUSIONS

We have been investigating the feasibility of entering the impact extrusion field. Do you have any information regarding people making equipment for this process. S.H.–Company President.

The E. W. Bliss Co. of Canton, Ohio and the Verson Allsteel Press Co. of Chicago, Ill. make presses suitable for the impact extrusion process.–Ed.



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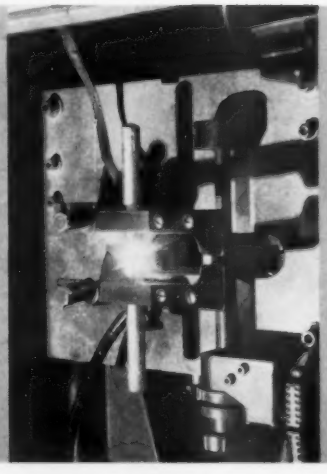

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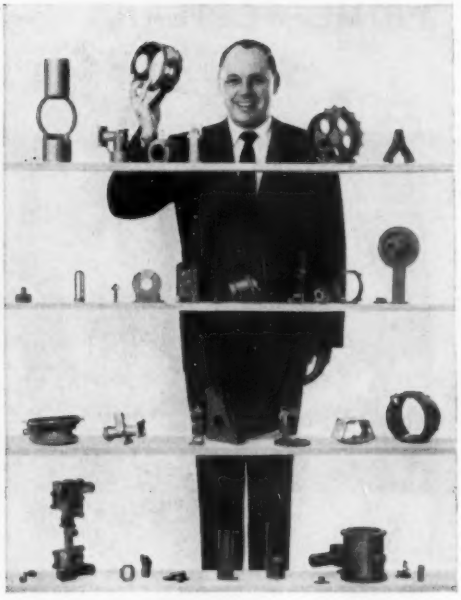

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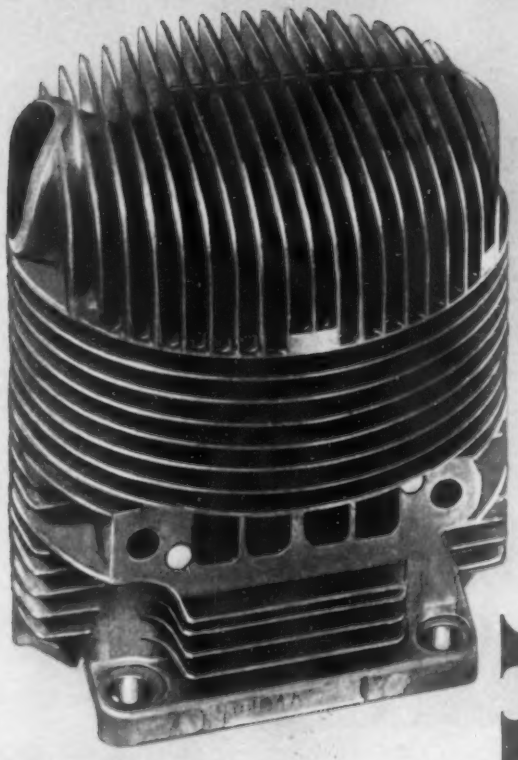

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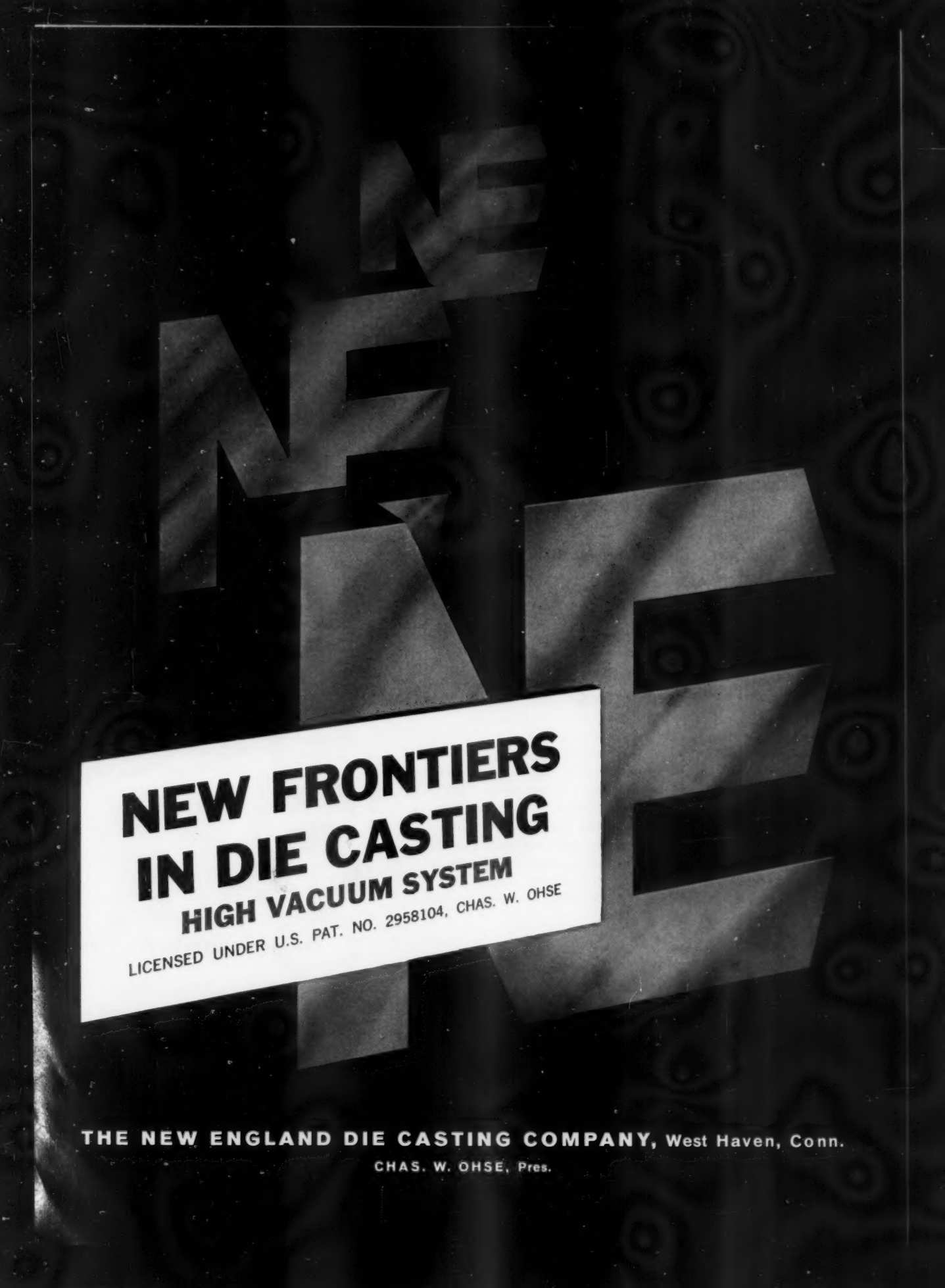
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WHY PRODUCT DESIGNERS SPECIFY DIE CASTINGS

A DESIGN ENGINEER'S NOTE BOOK

WHY DOES A product designer specify die castings? This was the basic question we asked Robert Koslo, project manager, and James Cahlik, assistant project engineer, at Designers For Industry, Inc.

Their answers tell both the design engineer and the vendor of die castings what's right and what's wrong with the state of the art today. Here are some questions we asked them and their answers.

At the start of a development project do you develop the functional components and then wrap it in a package, or do you have to start with the wrappings and fit the functional components into it?

Naturally, we have both conditions. Fortunately, however, most of the projects are not rigidly confined by either space or contour limits. We can't, of course, go hog wild on either size or shape where the client does not set down initial conditions.

In some cases our own designers develop the final design, get client approval, and then we start product design to come up with a functionally correct piece of equipment. In other cases the client may employ an outside industrial designer to work up the general appearance of the product and then turn this over to us to do actual product design.

Are you permitted to make any changes in appearance when a design has been developed and approved?

Only such minor changes as manufacturing efficiency requires. Naturally when we find that a change is required, we must have approval of our client and often the designer who worked up the original.

At what stage do you decide how any particular component shall be made?

This has to be done very early in our work. The method of manufacture will determine how we design each part. For example, we must first determine the anticipated production. Suppose a product will have limited sales and the design is subject to annual change. In such a case we would not consider any die cast parts unless later work showed a major saving.

On the other hand, even a limited annual production can make die castings attractive if the design will be static for several years. The basic question is, can you amortize your tooling and still show a manufacturing economy over the anticipated life of the die casting dies.

There's also the problem of installed tooling in our client's shop. If machine tools are avail-

able and time on them also is available, then die casting might not pay. If new machine tools would have to be purchased, then die casting becomes much more attractive.

Contour and finishability also come into the picture. These factors are, however, reflected in manufacturing economy.

In some cases an industrial designer will utilize shapes which lend only aesthetic appeal. Doesn't this increase the costs materially?

There's another of the great advantages of die casting. When we want a specially contoured part we can get it with die castings for little more than plainer surfaces. About the only cost penalty incurred is in die making and this doesn't amount to very much. Of course, you may have a slightly higher surface finishing cost, but again, this doesn't amount to very much.

How about interchangeability of parts?

There's another great advantage of die casting. For example, suppose a housing has to be made in two or more pieces. By almost any other method of manufacture the component parts would have to be selected for the best fit, then machined and finished as a unit. Should field replacement ever be necessary, the entire housing would have to be replaced.

Now with die castings, we can make the different parts separately with the assurance that at assembly we will get good fits. Edges will match, colors will be uniform, and surface texture will be uniform. What's more, in the field, any single component can be changed without having to change the entire housing.

There are a few occasions where a parting line has to be smoothed, but that's minor.

During the design of a product do you consult with vendors of parts?

Yes, always. We cannot be, and do not pretend to be, experts in all things. If a part which we believe should be die cast is anything other than quite straight forward, we always call in vendors and ask for their advice and help.

Sometimes this can get a bit troublesome, though. We have found that not all die casting vendors can do all jobs. We may have to hunt around a bit to find the man who can best make our part without too much change.

Further, if our client is in New Jersey, for example, it means that we have to work with die casters in that area. Often people like to buy their castings close to home. This isn't always true though. In many cases we get better parts at lower costs by going quite some distance from home.

Whenever possible we like to know the particular foundry that will make the part when it goes into production. Every foundry has its peculiarities and frequently these can require or permit a bit of design modification.

When we know the particular foundry we can send them complete sets of prints for their comments and suggestions so that our client gets his final drawings and specs.

Do you use mock-ups in your design work?

A mock-up is absolutely essential in developing a design. This is especially true when we are dealing with an item which has been designed by an outside industrial designer. With such a design we develop the components and then assemble them as models to make sure we have not departed too far from the original.

At this stage in our development work we will probably use clay or wood models. As the design progresses we will go to metal models, either machined sand castings or parts hogged out of wrought stock.

This brings up one of the most serious problems in designing for die casting. Obviously, we can't afford to make dies and cast one or two prototypes. Frequently, sand castings require so much machining that the cost of model building becomes exorbitant.

What we need is a foundry which can duplicate, precisely, a die casting. This applies to wall thickness, ribs, fillets, and especially cores and loose die pieces. We understand that there are a few foundries who do this sort of work, but don't know where any of them are located.

We fully believe that there would be a lot more die castings used if more accurate prototypes could be gotten at a reasonable cost. As it is, we sometimes design for a sand casting or for metal stampings because we can't afford the cost of prototype die castings.

In general do you find the mechanical and physical properties of die castings adequate?

Here you have a case of learning to live with what you have. If higher strength materials were available, which could be die cast, we would unquestionably use them in place of machined parts or forgings. For example, we recently designed a part which should have been die cast. Shape, appearance, and complexity of machining demanded it. But a die casting wasn't strong enough so we went to a fabricated steel part.

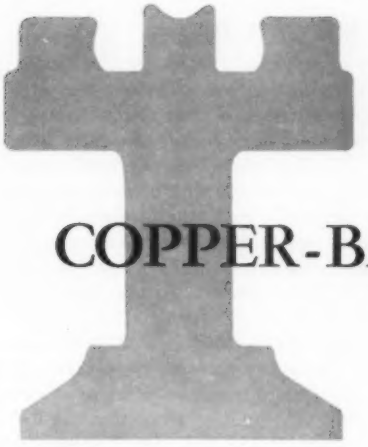
Finishability is another area where we need improvement. We have a die casting in the works right now which we are having trouble with. We can't get the finish we want and it's debatable whether we will stick with a die casting or go back to a stamping.

It's also probably true that if aluminum die castings could be anodized successfully we would use more than we do now.

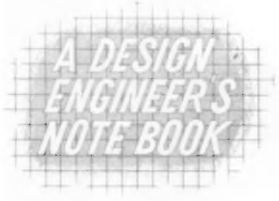
In your development work, if costs and function seem equal between die cast parts and sheet metal parts, which would you recommend?

Naturally, all things are seldom equal, but in such a case we would go to sheet metal because our research and development costs would be far lower. This is another example of the need for low cost prototypes.

Continued on page 90



COPPER-BASE EXTRUSIONS



EXTRUSIONS in copper-base alloys offer the design and production engineers a high degree of design flexibility and a means of cutting production costs.

Almost any property of wrought copper and copper-base alloys can be gotten in extrusions. A further outstanding advantage is the metallographic structure which resembles that of a forging, but in many cases is superior.

Let's examine, then, each of the points listed to determine why the designer should specify extruded sections.

Why use copper-base extrusions?

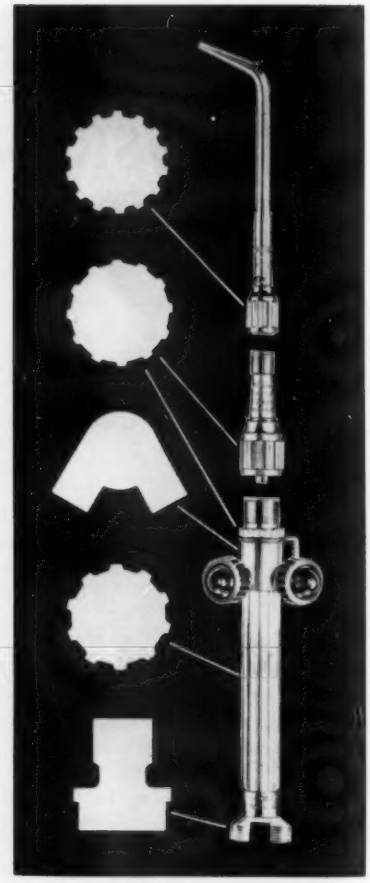
1. ***Excellent design possibilities***
2. ***Low production costs***
3. ***Simplified fabrication***
4. ***Fast deliveries***
5. ***Generally good machinability***
6. ***Good conductivity***
7. ***Good corrosion resistance***
8. ***Good surface finish***
9. ***Close dimensional tolerances***
10. ***Wide choice of alloys***
11. ***Excellent mechanical properties***
12. ***Orders can be fairly small***

1. *Excellent design possibilities*

Extrusion lets you put metal where you want it. You don't have to compromise design because of casting practices or machining difficulties. Many shapes which are functionally correct are economicallly impossible if only casting and/or machining are considered. But with extrusion, these difficult or impossible shapes are as easy to push as a simple one. The only cost penalty you'll have to pay is a slightly higher tooling charge and, in many cases, not even that.

Here's an example: the Oxy-Acetylene welding torch (figure 1) made by National Welding Equipment Co. The hose connection is machined from a brass shape and silver soldered to the fluted handle, also made from an extruded shape. The needle valve controls, machined from a third shape, are silver soldered to the handle. The two mixers are made from a fourth shape, and finally the nut which fastens the tip to the handle is machined from a fifth shape.

Through the use of these extrusions a torch can be made, which is easy to handle, comfortable to hold, light in weight, and inexpensive. No other fabricating method would have done any of these jobs as well.



1. FIVE EXTRUSIONS are used to make the handle of this welding torch. A comfortable, light weight economical unit is the result.

2. *Low production costs*

It isn't always possible to get the finished shape you want as an extrusion. When this is the case, design the extrusion so that machining is reduced to a minimum. For example, the pipe strap shown in figure 2. This piece was formerly made from the casting shown in the center. By a shift to an extrusion (part on the left) the only machining needed was to bore the hole for the pipe and drill and countersink two mounting holes. Little buffing and polishing are needed to prepare the part for chromium plating. The result was a pipe strap which weighed one-third less than the cast piece and there was a 28% manufacturing cost reduction. Another example of the cost saving possible through the use of extrusions is shown in figure 3. The part is a terminal block on a high frequency transformer, a so-called "fishtail". It was originally made by machining from a block of copper. On a typical run of parts the total cost for the number of pieces made was $35,000.

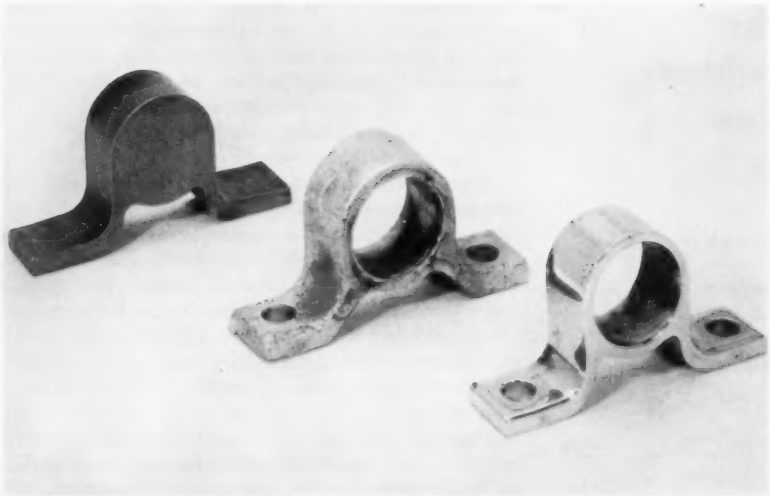
An extruded bar was substituted for the solid stock. The cost of the extrusion was 10¢ per pound more than the plain bar stock. On a run of the same number of parts as before, but starting with the extruded shape, the cost was $25,700, a saving of $9,300 or 26.6%.

Mechanical properties were of minor importance in the fishtail, but physical properties were important. There was no sacrifice by using extrusions.

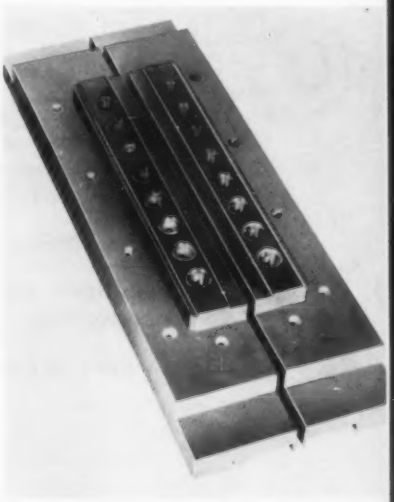
3. *Simplified fabrication*

Take a close look at the shapes shown in figure 4. Almost every one of these shapes would require extensive and multiple fabricating. Most of them would have to start as flat sheet or bar stock. Bending, roll forming, machining and brazing would all be required to get the final shape needed.

The raw material stocking problem would be



2. LIGHTER WEIGHT, lower cost, simplified manufacturing are the advantages of extrusions in making brass pipe hangers.



3. HIGH CONDUCTIVITY, low machining costs, and minimum scrap resulted.

severe and unless a wide variety of strip widths were in stock, slitting would have to be done.

All this would be necessary to make the shapes if they were not extruded. As extrusions, it's relatively simple to make up a die and push the metal through it to end up with just the shape wanted—no bending, no machining, and no joining.

There's a further advantage the designer should consider. If any of the complex shapes are needed in copper or copper-base alloys (either heat or current carrying members), the conductivity will be reduced if a joint must be used. The reduction may not be severe if a large lap can be made, but in sections which might be extruded instead of formed and joined this is seldom the case.

4. *Fast delivery*

Normally, deliveries from the extrusion mill are fast. Once designs have been approved by both the customer and the mill, dies can be made quickly. This is especially true of solid shapes.

The actual extrusion operation is extremely rapid, and when the proper alloy is running, die changes can be made very quickly. It is seldom that initial deliveries are longer than a very few weeks after design approval. This assumes, of course, that a new die must be made. On repeat orders where the mill need only take a die from stock and run the metal, delivery is extremely rapid.

In many cases extrusions can be gotten in a fraction the time required to buy flat stock and tool-up for bending, drawing, or machining.

But fast delivery may not be the only advantage in many cases. Remember that through the use of extrusions machine tools are either freed for other work or possibly do not have to be purchased at all. There may be no metal scrap problem at all, and even if machining is done on the extruded section, it is always far less costly than machining from bar stock.

TABLE I—COMPARATIVE MACHINABILITY RATINGS OF COPPER BASE EXTRUSIONS.

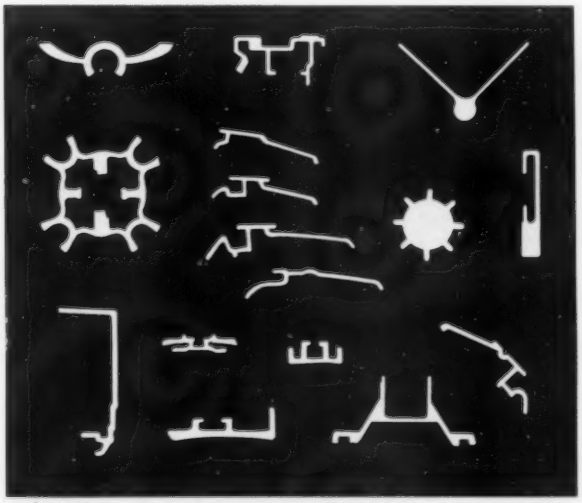
Alloy	Rating
Electrolytic Tough Pitch Copper, OFHC Copper, Silver Bearing Coppers	20
Free Cutting Copper	80-100
Free Cutting Brass	100
Forging Brass	80
Heavy Leaded Architectural Bronze	90-100
Architectural Bronze	90
Threshold Bronze	90
Naval Brasses	30
Leaded Naval Brasses	70
Manganese Bronze, Nickel Silver	20
Muntz Metal	30
Arsenical Bronze	50
Low Leaded Brass	60
Riveting & Turning Alloy	90

5. *Good machinability*

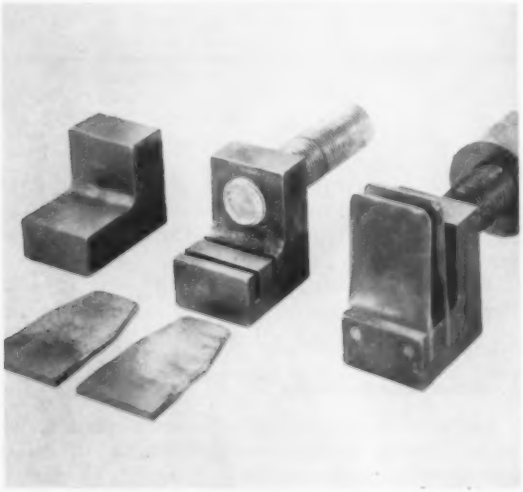
Generally, extruded copper and copper-base alloys machine as easily (or as hard) as the same metal in wrought bar or rod stock. Provided the alloy composition and the temper are the same, standard machining practices of bar stock may be followed with extrusions.

For general machining comparison, a table of machinability has been developed. This table is based on so-called freecutting brass as the easiest alloy to machine; it has a machinability rate of 100. Those metals which are difficult to machine and which produce long, tough, stringy turnings, have arbitrarily been given a 20 rating. Table I gives the machinability ratings of the commonly extruded metals.

In rating the machinability of the alloys given



4. COMPLEX SHAPES are easily and inexpensively produced as extrusions in copper, brass, and bronze.



5. ASSEMBLY COSTS are less when an extruded shape replaces machined or stamped parts.

TABLE II THROUGH TABLE VII
MACHINING AND TOOL DATA FOR COPPER BASE EXTRUSIONS.

TABLE II—TURNING

	Type of Tool	Relief Angles Degrees		Rake Angles Degrees		Surface Speed Feet per Minute	Roughing Feed, in Thousandths of an in. per Revolution	Finishing Feed, in Thousandths of an in. per Revolution
		Side	Front	Back	Side			
Alloys having a Machinability Rating Between 70 & 100	Standard High Speed Steel	0-5	6	0	0-3	300-700	8-15	5-8
	Carbide-Tipped	4-6	4-6	0	2-6	500-1000	8-15	5-8
Alloys having a Machinability Rating Between 30 & 60	Standard High Speed Steel	5-10	6-15	5-10	5-10	150-300	3-8	3-6
	Carbide-Tipped	4-8	4-8	0-5	4-8	400-600	3-8	3-6
Alloys having a Machinability Rating of 20	Standard High Speed Steel	10-20	10-15	10-20	20-30	75-150	3-8	3-5
	Carbide-Tipped	7-10	7-10	4-8	15-25	300-800	3-8	3-5

TABLE III—MILLING

Alloys	Rake Angle Deg.	Relief Angle Deg.	Lead Inches	Surface Speeds Feet per Minute
having a Machinability Rating between 70 and 100	0-10	10-15	0.015-0.030	200-500
having a Machinability Rating between 30 and 60	0-10	5-15	0.015-0.030	150-200
having a Machinability Rating of 20	0-15	5-15	0.015-0.030	50-150

in Table I, consideration was given to speed of machining, tool wear, finish, accuracy, and power required. The ratings are useful only for approximate guidance in machining.

Feeds and speeds as well as tool shape are also difficult to set. However, as a general guide Tables II, III, IV, V, VI, and VII are useful.

6. *Good conductivity*

Extruded shapes will have the same conductivity as bar stock of the same composition and the same temper. This applies to both thermal and electrical conductivity and for that matter, to all of the physical properties.

As we noted above, for shapes which might have to be built up by welding, brazing, or soldering, by using an extrusion the conductivity is generally improved. The form of the joint, the ratio of joint area to total area, and the kind of joining metal used will all have an effect.

Whenever possible it is best to assume an appreciable loss in conductivity if a joint must be made. This is particularly true on butt joints, and on any imperfect joints.

7. *Corrosion resistance*

As in the case of machinability and conductivity, the corrosion resistance of extruded shapes is the

TABLE IV—DRILLING

Classification	Clearance Angle Degrees	Drill Point Angle Degrees	Cutting Edge	Speed Ft. per min.
Alloys having a Machinability Rating of 70-100	12-15	118	Flatten to 0° Rake	300-700
Alloys having a Machinability Rating of 30-60	12-15	118	Flatten to 0° Rake	75-250
Alloys having a Machinability Rating of 20	12-20	100-110	Full Rake	50-125

TABLE V—THREADING AND TAPPING

Machinability Rating of Alloys	Linear Threading or Tapping Speed, feet per minute
70-100	100-200
30-60	50-90
20	10-30

TABLE VI—BAND SAW CUTTING

Machinability Rating of Alloys	Stock Diameter or Thickness, Inches					
	1/16 to 1/4		1/4 to 1		Over 1	
	Teeth per in.	Velocity, ft. per min.	Teeth per in.	Velocity, ft. per min.	Teeth per in.	Velocity, ft. per min.
70-100	18	500-1000	10	350-450	4	250-350
30-60	18	250-350	10	230-250	4	200-230
20 (Except copper)	18	250-300	10	200-250	4	150-200
Copper	18	800-1500	10	600-1000	4	300-600

TABLE VII—POWER HACK SAW CUTTING

Machinability Rating of Alloys	Stock Diameter or Thickness, inches			
	1/4 to 1		Over 1	
	Teeth per in.	Strokes per min.	Teeth per in.	Strokes per min.
70-100	6-10	130-150	4-6	130-150
30-60	6-10	90-120	4-6	90-120
20	6-10	60-90	4-6	60-90

same as wrought metal of the same composition and temper.

Where a built-up section is used instead of an extruded shape there can be a severe corrosion problem at the joint. This can generally be avoided by the use of an extrusion.

When copper or copper-base extrusions must be joined to some other metal, the same care to avoid electrolytic corrosion must be exercised as is shown with other joints between the same two metals.

Normally, copper or brass fastening devices are used. When steel fasteners must be used, the two metals must be insulated from each other to prevent electrolytic corrosion. Use stainless steel fasteners where possible.

8. *Surface finish*

One of the outstanding advantages of extruded shapes is the ease with which they can be surface finished. In many cases all that is necessary is to cut-off to length and barrel finish.

Any finishing method suitable for copper or copper-base alloys can be used with extrusions. The one great difference is that with extruded shapes, when buffing and polishing must be done, much less work on the extruded surfaces is necessary. If machining has been done, then finishing will depend on the kind of surface left by the machining operations.

In general, the poorest surface will be found on shapes extruded in electrolytic tough pitch copper, OFHC copper, and silver bearing coppers. These materials may show profilometer readings as high as 500 microinches. Most other alloys will have a maximum profilometer reading from 125 to 250 microinches.

When a better than commercial finish is required the extruder should be informed. Special care in die polishing and possibly drawing after extruding may be done.

The second part of this article on copper-base extrusions will appear in the June 1961 issue and will include information on items 9-12.

GATING ZINC DIE CASTINGS

. . . an examination of current practice

By RALPH WILCOX,
Metallurgist,
American Smelting
and Refining Co.

A DESIGN ENGINEER'S NOTE BOOK

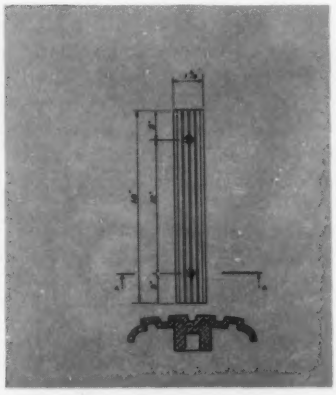
THE LOCATION, shape, and size of the gate through which molten zinc alloy is injected into a die casting cavity has a great effect upon the soundness and surface finish of the casting.

Many companies have spent large sums of money to install the finest and most modern die casting equipment only to find that equipment alone does not guarantee success.

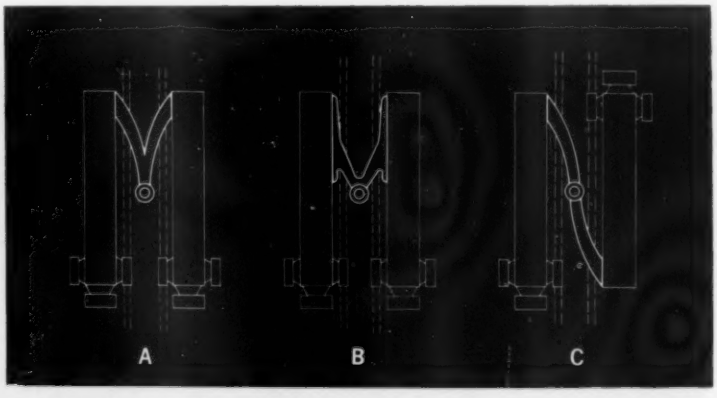
Unfortunately, no one as yet has been able to develop a fixed rule or formula to guide the die caster in the important task of gating a die casting. As a result, past experience is of tremendous importance and is usually a jealously guarded stock in trade.

The methods of gating illustrated by this article are not exclusively the author's. They represent ideas and information gained over a 25 year period from personal contact with men who pioneered in the manufacture of zinc die castings in the United States. These men learned how to successfully gate die castings to obtain a hardware finish through actual experience.

Based upon three years of actual trial in a commercial plant, the following ideas on gating are presented with the assurance that they will produce



1. DIE CAST zinc alloy automotive garnish molding.



1. A-C Three variations of a backup type gate.

satisfactory results when combined with proper die design and construction, suitable die casting equipment, and competent production techniques.

GATING RECTANGULAR SHAPED CASTINGS

Figure 1 illustrates a garnish molding casting for an automobile. Figure 1-A through 1-J show in plain view ten sets of these castings with gates, runners, sprues and overflow wells attached showing various methods of gating this casting for production in a two cavity die.

Assume that these castings are produced in a hot chamber machine, the gate runners are in the movable half of the die, and the surface of the casting to be plated is in the stationary half.

Back-up type gate

Methods A, B and C are three variations of a "backup" type gate in which the metal is injected into one end and back fills the rest of the casting. This is a fairly satisfactory gating method, but the tendency here is to overheat the gate end in order to bring the opposite end up to proper temperature. To help minimize overheating the gate end, it is usually necessary to add good sized overflow wells as shown. These may require a volume ⅛ that of the casting.

While the primary purpose of an overflow well is to help maintain a uniform die temperature, it also helps to provide additional venting.

Method C makes for a more balanced die than A or B because the gate runner areas are well distributed over the die block. All three methods provide for adequate cooling of the runner and gate by circulating water through channels drilled in the movable half of the die. The dotted lines in the figures indicate the probable location of these water lines. All would permit easy removal of the gate, overflow wells and flash in a trim press. The gate thickness for A and C would probably have to be at least .035″ to .040″ whereas in method B the thickness of the gate opening could be reduced about .005″ because of the gate's greater length.

End gate

Methods, D, E, F, and G are four variations of an end gate in which the metal is injected into one end in a way to permit the metal to move in a direction parallel to the main axis of the casting. Method D might appear at first the most likely to produce a good casting, however, methods E, F, and G are better. Method G is the best of the four because it tends to keep the incoming stream of metal more compact. Methods D, E and F generate more turbulence. Furthermore, methods E and F will usually require more overflow wells than D or G to obtain a good surface finish.

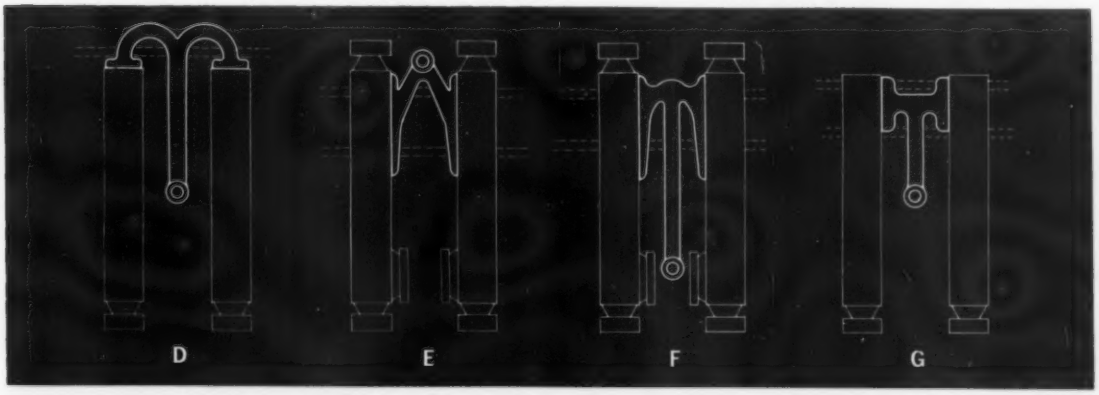
Methods E and F are essentially the same gate except the sprue hole has been moved off center to achieve a certain directional flow in the runner system and still permit the die to be centered on the die casting machine between the tie rods.

The gate thickness of D and G would probably have to be at least .035″ to .040″ whereas this could be reduced about .005″ in E and F because of the greater length of gate opening.

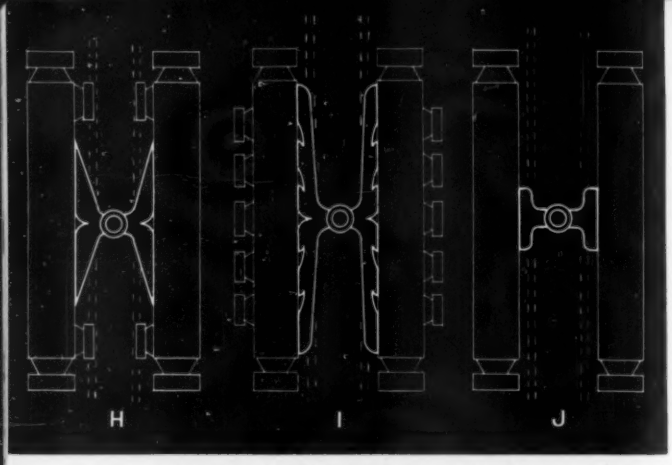
All four of the methods, D, E, F and G permit easy cooling of the runner and gate by means of water channels drilled in the movable half of the die. These four methods also permit easy removal of the gate, overflow wells and flash by a trimming die. However, methods E and F might present a somewhat more difficult trimming problem because of the greater length of the gate and additional overflow wells.

All of the methods D, E, F and G result in an unbalanced die because gate and runner areas are concentrated in one end of the die block. This condition is likely to produce uneven wear on dowel and ejector pins.

Also, with methods D, E, F, and G there is a tendency to overheat the gate end in order to bring the opposite end up to the proper temperature. To help heat the ends of the die cavity farthest from the gate and to help vent the die cavity, it is usually necessary to add overflow wells as shown. These may require a combined volume anywhere, from about ⅛ to ½ of the volume of the casting, depending on the method used.



1. D-C Four variations of an end gate.



1. H-J PLAN VIEW of the die casting shown in figure 1 produced in a two cavity die by gating methods shown.

Center type gate

Methods H, I and J are three variations of a center type gate. Method H is a comb type gate, and J a "T" type gate. The center type gate usually produces a better balanced die than gating methods A through G because the gate and runners are evenly distributed and centered between the tie rods. Also, with the center type gate there is less tendency to overheat the gate opening in order to raise the die to the proper operating temperature.

Furthermore, the center type gate permits easy cooling of the gate and gate runner areas and offers no great difficulty in removing the gate, overflow wells and flash by a trimming die. Method H and I might offer a more difficult trimming problem than J because of the longer gate and additional overflow wells.

With regard to the thickness of the gate opening, method J would probably require a thickness of at least .035" to .040". This no doubt could be reduced by about .005" for methods H and I because of the greater length of the gate opening.

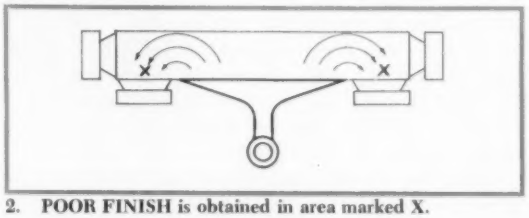
While the center gate has a number of advantages, it also has several disadvantages. For example, one disadvantage of the fan gate (method H) is that it is difficult to obtain a good finish at areas adjacent to the end of the gate (see figure 2.) The metal back fills these areas as indicated by the arrows rather than flowing across. Therefore, it is usually necessary to add a good sized overflow well at these points to draw sufficient metal out of the cavity to prevent the formation of cold shuts, swirls, and the entrapment of air.

Note the use of a divider or spreader in method H. This is a small "V" shaped island located on the middle of the gate. The spreader was originally used to facilitate removal of the gate by hand breaking, particularly on circular castings. It is seldom used in modern gating practice where the gate, overflow wells, and flash are removed by a trimming die. The exception would be to prevent direct impingement of the incoming metal on a core or similar critical obstruction. Even in these cases, many die casters will flash the island with a .015" to .020" flash.

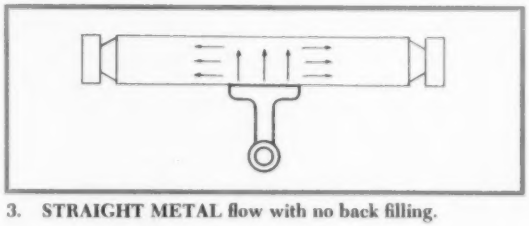
The disadvantage of the fan gate is not found in method J. With this gate the metal is injected in a compact stream at a 90° angle to the main axis of the casting cavity. Then the metal flows from the center to the ends of the cavity with little or no back filling (figure 3).

Center gate method I has two particular disadvantages over methods H and J. (1)—It is more difficult to cool the gate and runner area because of its size in relation to the casting. (2)—It is more difficult to obtain good surface finish suitable for plating because of excessive splitting of the runner and gate system. This produces considerable back filling of the cavity in the areas between the gate openings (figure 4). This back filling is likely to cause swirls, cold shuts and entrapment of air. To prevent or minimize this, it is usually necessary to add fairly large overflow wells at these points to draw sufficient metal out of the cavity.

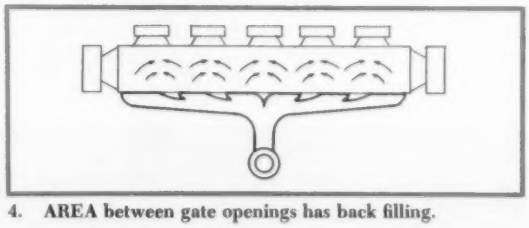
Method J avoids the backfilling disadvantage and still retains all the other advantages of a



2. POOR FINISH is obtained in area marked X.



3. STRAIGHT METAL flow with no back filling.



4. AREA between gate openings has back filling.

center gate such as good balance, minimum gate area, and good heat distribution.

To summarize the gating of rectangular shaped castings, methods A through J, along with their many modifications, all will produce a casting with fairly good surface finish. However, method J will yield the best overall results when it can be used. Method G is an excellent alternate choice for those castings that will not permit a center gate because of cross section, contour, or other reason.

Part II of this article will appear next month.

HOW DIE CASTING DESIGN AFFECTS TOOLING COSTS

By E. F. HANNON, *Chief Engineer,*
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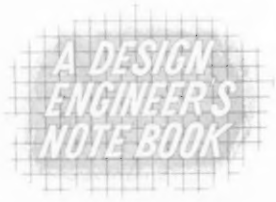


SIMPLIFICATION of design, the increase in draft, addition of a low cost machining operation, and many other seemingly minor changes can have a large effect on both the cost of die casting tooling and on the final piece cost.

Even though a successful bidder has been selected for a given job, the consultation between design and production should not stop. By continued cooperation it is often possible to affect major economies which, originally, did not seem possible or were completely overlooked. The following notes on die casting die design will, it is hoped, help both designers and producers of die castings get the best possible part at the lowest possible cost for both tooling and casting.

Design for zinc castings

For zinc base alloy die castings, the die designer must establish the location of the cavity, or cavities, with respect to the sprue location. He then decides the placing of ejector pins for proper removal of the casting from the die with minimum distortion.

It is always preferable to locate the ejector pins directly on the part for a direct push. The lifting effect of so-called outboard ejectors is not always effective.

The choice lies between a flash mark around the pin on the casting, or an excessive flash at the parting line to tie the ejector boss to the part.

The gate should be generally placed at a location where the inlet scar will be least detrimental to the finished part. Oftentimes a subsequent machine operation can remove the evidence of the inlet.

It should be remembered that the gating of the die is the most important step toward producing a clean, well filled part. Proper gating will effect minimum porosity and high quality finish.

Overflows serve a definite purpose in providing a well for collection of lubrication debris. Air spaces beyond, open to the atmosphere, allow the escape of gases in the cavity.

Beyond each overflow, a pad .020-.030 deep, leading to an air space of .008-.010, should be provided so the flash will leave the die with the casting.

The choice of steel for zinc base alloy casting dies depends entirely on the production requirements of the part. For modest quantities, the use of prehardened steel, about 300 Brinell, is effective in reducing initial die costs.

Any movable parts such as cores, slides or ejectors should be of air hardened steel. Bearing surfaces beyond the cavity should be nitrided to prevent galling and scoring.

In cases where greater production is anticipated, the holding blocks can be prehardened steel. However, the cavity blocks should be inserted. They should be made of air hardened 5% chromium steel, heat treated to 44-46 Rockwell C.

For maximum production and long die life the finest materials available must be used for minimum downtime and maintenance of dimensional accuracy.

Many factors can affect the cost of a casting die. Among them are the choice of parting line for a particular part. If the parting line can be on one edge of the part in a single plane, the entire cavity can be in one half of the die, for obvious economy. However a sharp corner will result.

Another economy comes with adequate draft which reduces the number of ejectors required to smoothly remove the casting from the die.

Inserted blocks in dies often measurably reduce the cost of intricate cavities involving deep ribs, sections or blind cores in inaccessible places. They also lessen the distortion in heat treating.

In some cases, when the production requirements are modest, the die cost can be substantially reduced. Redesign the end item to assemble two or more parts for simple die design rather than draw numerous cores requiring massive dies to cast a one piece part.

Design for aluminum castings

Since we are concerned only with cold chamber casting machines, the location of the injection plunger is limited to the horizontal centerline and one lower in the stationary platen. Therefore, the runner must emerge from the top of the plug and lead to the cavities. The location of the cavities is dictated by the available space. If cores or slides are involved, care must be exercised to avoid tie bar interference.

Overflow requirements for aluminum casting dies are even more important than for zinc casting dies. Aluminum alloys are less fluid and more lubrication is required to release the part.

Except in extreme cases, ejector pins should be on the casting proper to reduce the seizing and tearing so inherent in aluminum alloys.

When designing for aluminum die castings the choice of steel for cavities, cores, slides and ejectors is narrowed to the air hardenable 5% chromium steels. For modest production jobs the holding blocks may be of S.A.E. 4140 or other prehardened types. Core and slide surfaces which move in the die blocks must be nitrided.

If the configuration of the part permits, a replaceable insert, in the cavity at the inlet area, will permit repair of the erosive damage sure to occur.

The erosive effect of the metal flow can be minimized by directing the flow of metal along the die wall rather than allow direct impingement.

The direction of the inlet should seek to avoid striking cores, causing soldering and erosion.

Trim dies

Trimming the part is directly affected by the design and construction of the casting die.

The designer must always bear in mind that his choice of parting lines, ejectors, cored holes and other openings has a pronounced effect on flash removal.

Where possible, parting lines should be kept in a flat plane. If steps are necessary, they should extend to the edges of the die to avoid pockets. Such pockets will trap particles of flash and interfere with the proper reclosing of the die.

Another expedient to reduce trim die costs is to incorporate integral cast punch cavities in the casting die where a multiplicity of small openings is required. This procedure consists of casting slugs slightly smaller than the required opening in the opposite half of the die. These slugs are pushed through by a flat punch in the trim die rather than by trying to fit punches to each individual opening.

The die designer is faced with a responsibility to his management, the die maker, the production department and last, but not least, the customer.

The designer of the part also contributes much to the final result by close attention to sensible tolerances, adequate draft (especially in corners and holes), fillets at the entrance to cored holes, choice of inserts for easy loading in the die, type of engraving (raised is least expensive), wall thickness, choice of ribbing and generous allowance for location and number of ejectors.

DESIGN POINTERS

FOR ALL DIE CASTINGS

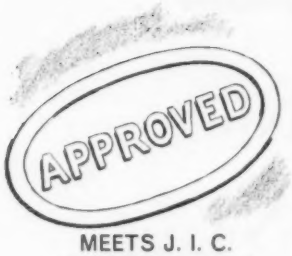
- Provide adequate draft.
- Keep tolerances sensible.
- Permit fillets at entrance of cored holes.
- When inserts are used, design for easy loading.
- Lettering on casting should be raised if possible.
- On thin walls, provide adequate ribbing. Keep walls as thick as possible.

FOR ZINC DIE CASTINGS

- If possible, permit ejectors to bear directly on the part.
- Consider gate location with respect to final finish and soundness.
- Design must allow for sufficient overflows and vents.
- Provide for a parting line in one plane whenever possible.
- Allow maximum drafts on sidewalls and cores.
- When possible, permit the use of insert blocks on complex designs.
- Consider the use of two or more castings instead of one very complex casting.
- Remember the part has to be trimmed. Keep hand trimming operations to a minimum.
- When there are many small openings in the part, design for integrally cast punch cavities; this lowers trim die costs.

FOR ALUMINUM DIE CASTINGS

- Location of the cavity in the die block is rigid, avoid cores and slides which will interfere with the machine tie-bars.
- Allow for plenty of overflows, aluminum castings require more overflows than zinc castings.
- Ejector pins should always bear on the castings.
- If possible, allow the use of an insert at the inlet area where erosion is sure to occur.
- Metal flow should be along the die walls, not direct impingement.
- Metal flow should not impinge directly on cores or slides.



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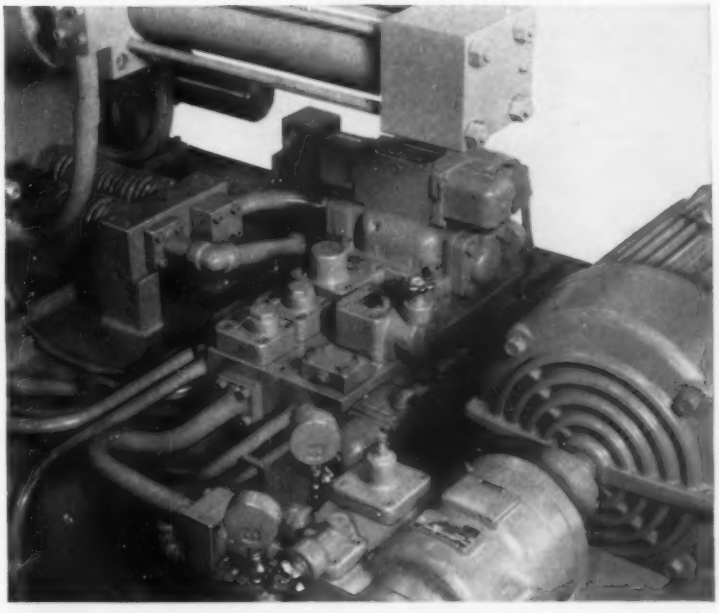

Hydraulic valves are manifolded where possible. Piping is extra heavy and all connections are welded flanges with "O" ring seals. These prevent costly leakage especially when flame-resistant hydraulic oil is used. You pay no more for this extra-quality advantage on any Greenlee - B & T Die Casting Machine. Write for complete information or let us arrange for a demonstration.

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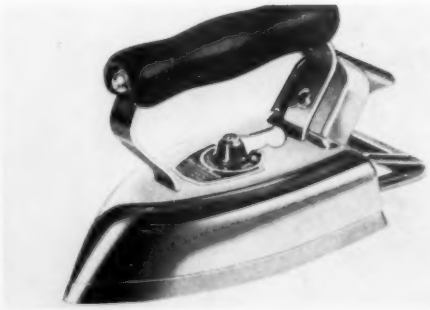
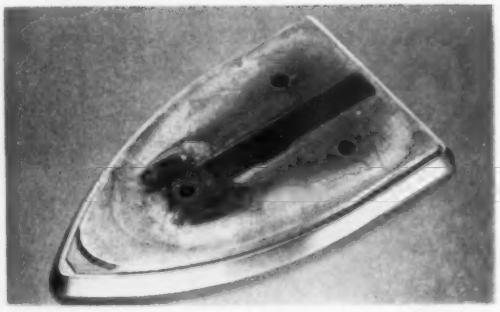
A CAST IRON PERMANENT MOLD CASTING





IRON for industrial and commercial usage is designed and intended for heavy-duty requirements. Sole plate must quickly respond to temperature changes.

HARDNESS, DURABILITY, and non-staining properties were needed for this sole plate for a commercial laundry iron. That's why it is a gray iron permanent mold casting. The plate had to be heavily machined (10% of the weight is removed) to get the smooth surfaces. During this machining at least 3/32" of the surface is removed so that the tool can cut under the hard skin layer.

The most critical as-cast dimension is the slot on top for the thermostat. This slot is not machined and is held to ±1/64". The casting is annealed and grit blasted before machining. The edges and bottom are polished and chromium plated.

The five-pound weight of the sole plate is not objectionable because the iron is used only commercially or in institutions. It is made by the American Electric Heater Co.

A requirement of 500 castings a month made the permanent mold method more economical than sand casting. Also, sand would have permitted troublesome porosity. Sometimes this porosity cannot be seen with the naked eye, yet will spoil the plated finish.

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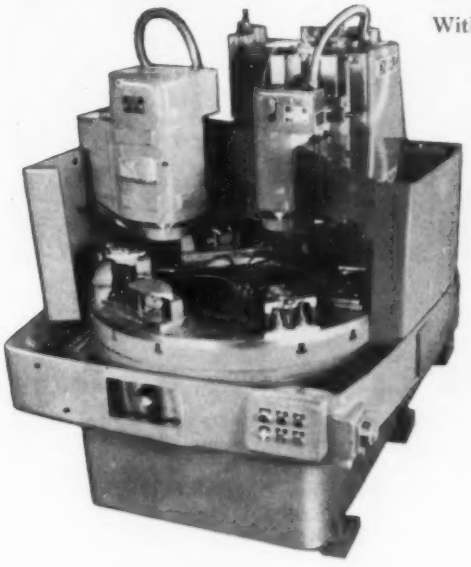

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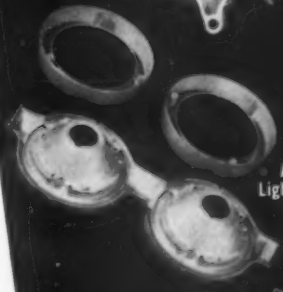
TYPICAL PRODUCTION MILLED PARTS

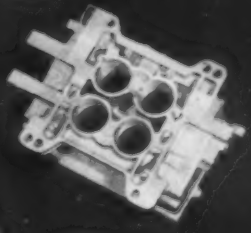
Motor Head—360 parts per hour. 30 R.M.S.

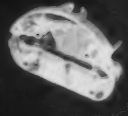
Carburetor Part — 400 parts per hour. Flatness .0005".



Automobile Tail Light Bezels—300 parts per hour. Burr free.

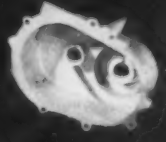
Carburetor Body—350 parts per hour. 35 R.M.S.

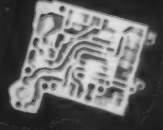




Wattmeter Base—profile milled. 275 parts per hour.

Transmission Cover—300 parts per hour. 40 R.M.S.





Automatic Transmission Part—200 parts per hour. 20 R.M.S.

Outboard Motor Part—310 parts per hour. Milled three faces. 35 R.M.S.

Camera Case Housing—360 parts per hour. Mill trim to 6 R.M.S.

Camera Gate Part—720 pieces per hour. Tolerance .0005".

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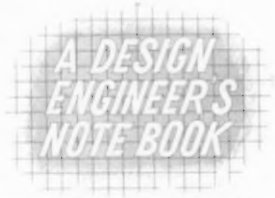
TANTUNG INVESTMENT CASTING

for intricate configuration

plus wear . . . heat and corrosion resistance

By R. A. HASKELL, *Metallurgical Consultant, Cast Alloy Department, and*
A. N. NEYRINCK, *Engineer Cast Alloy Department.*



TANTUNG is the trade name of a family of proprietary cast alloys developed and produced by Vasco-loy-Ramet. They are comprised principally of cobalt, chromium, tungsten, columbium and carbon.

Main characteristics of the alloys are high red-hardness, high transverse rupture strength (about double that of most cast-alloys), low coefficient of friction and excellent resistance to corrosion. They are tough and highly resistant to shock and impact. They are also non-magnetic.

Tantung retains its hardness at red heat temperatures well above those at which high speed steel "burns up." It will not withstand as much heat as tungsten carbide, but has higher shock resistance. (See Table I for typical physical properties of alloy 166A, the most popular alloy for investment castings). The resistance to corrosion of Alloy 166A is shown in Table II.

In addition to 166A, four other alloys have been developed which offer variations in the basic physical properties. Table III shows the complete group of alloys now available for investment castings.

Size range

These alloys can be investment cast in a size range from the smallest part which can be physi-

TABLE I—PROPERTIES OF TANTUNG 166A

COMPOSITION RANGE	Cobalt	45-50%	Tantalum or Columbium	2-7%
	Chromium	27-32%	Manganese	1-3%
	Tungsten	14-19%	Iron	2-5%
	Carbon	2-4%		
HARDNESS	HARDNESS as measured on ¼" sq. to 1" sq. solids cast in refractory molds. (Investment castings for wear and corrosion resistance)—53 to 57 Rockwell C.			
LINEAR COEFFICIENT OF THERMAL EXPANSION	.0000075 inches per inch per degree F over range 100 to 1200 deg. F.			
TRANSVERSE RUPTURE STRENGTH OF REFRACTORY MOLD CASTINGS	Breaking Load	Approx. 4,000 lbs.		
	Modulus of Rupture	Approx. 175,000 psi		
TENSILE STRENGTH OF REFRACTORY MOLD CASTINGS	Threaded Tantung Test Bars 0.505" Dia.	Approx. 65,000 psi		
THERMAL CONDUCTIVITY	.064 Cal/cm²/cm/°C/sec			

HOT HARDNESS (MUTUAL INDENTATION)	Temperature of test Degree F	Brinell Hardness (3000 kgm. load for 30 seconds)
	Room	654
	800	479
	1200	479
	1600	267
	1800	114

TABLE II—SOLUBILITY OF ALLOY 166A

REAGENT		CONCENTRATION	TEMPERATURE	DID TANTUNG CORRODE?
Hydrochloric	HCl	50% Solution	Room	YES
Hydrochloric	HCl	100% "	Room	YES
Sulfuric	H_2SO_4	50% "	Room	YES
Sulfuric	H_2SO_4	100% "	Room	YES
Sulfuric	H_2SO_4	100% "	85° C — 185° F	YES
Nitric	HNO_3	50% "	Room	NO
Nitric	HNO_3	100% "	Room	NO
Nitric	HNO_3	50% "	85° C — 185° F	YES
Nitric	HNO_3	100% "	85° C — 185° F	NO
Hydrofluoric	HF	50% "	Room	YES
Phosphoric	H_3PO_4	50% "	Room	NO
Phosphoric	H_3PO_4	50% "	85° C — 185° F	NO
Organic	Acetic	50% "	Room	NO
(Fruit & Vegetable)	Acetic	50% "	85° C — 185° F	NO
(Fruit & Vegetable)	Lactic	10% "	Room	NO
(Fruit & Vegetable)	Lactic	10% "	85° C — 185° F	NO
(Fruit & Vegetable)	Citric	10% "	Room	NO
(Fruit & Vegetable)	Citric	10% "	85° C — 185° F	NO
(Fruit & Vegetable)	Oxalic	10% "	Room	NO
(Fruit & Vegetable)	Oxalic	10% "	85° C — 185° F	SLIGHT
Sodium Carbonate	NA_2CO_3	10% "	Room	NO
Sodium Carbonate	NA_2CO_3	10% "	85° C — 185° F	NO
Potassium Hydroxide	KOH	33⅓% "	Room	SLIGHT
Potassium Hydroxide	KOH	33⅓% "	85° C — 185° F	YES

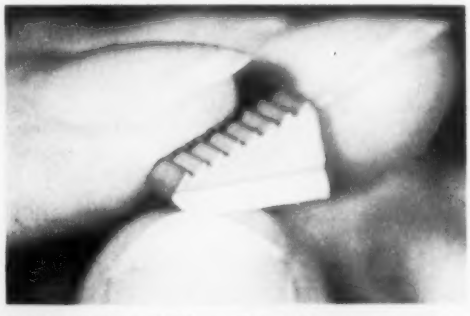
cally handled to a part six inches (6") by two and a half (2½"). Larger castings can be cast by permanent mold, sand or a combination of investment, sand, or permanent mold. The illustrations show the range of parts which have been investment cast.

Note that one part, a mold plunger, is a semi-permanent mold casting. A ceramic core was used in this part.

Casting tolerances

The Tantung alloys all have excellent casting properties. The metal flow characteristics are such

MOLD PLUNGER is a combination of permanent mold casting and investment casting, has heat and wear resistance.



LOCK CAM is held to close tolerances, has sharp detail, high strength, and corrosion resistance.

CORRUGATED KNIFE cuts slices of pickles, potatoes, etc. It has a long edge life and is corrosion resistant.

BURNER PLATE combines high wear resistance with heat and corrosion resistance. A good finish is required, as-cast.

TABLE III—HARDNESS AND APPLICATION INFORMATION OF ALLOYS FOR INVESTMENT CASTING

ALLOY #	R/C HARDNESS RANGE	APPLICATION INFORMATION
Alloy 144A	55-59	More wear resistant than 166A. Has similar properties, but has a lower transverse rupture strength. Abrasion resistant.
Alloy 166A	52-57	Most popular alloy used for resistance to wear, abrasion, corrosion, continuous heat. Can be used for some cutting applications, such as cloth, thread, wood, plastic, etc. It is non magnetic.
Alloy 162A	47-51	Has a higher transverse rupture strength, but a little less wear resistance than 166A. Other properties are similar. 162A is used for casting delicate thin sections to minimize breakage.
Alloy 148	32-37 As Cast 42-48 Heat Treated	Shock resistant while retaining good wear qualities. Used where mild heat shock occurs. It is resistant to corrosion and is non magnetic.
Alloy 171	28-32	Resistant to corrosion. Will stand severe heat shock combined with good wear characteristics. It is also non magnetic.

that both thin and heavy sections are filled, allowing the metal to lie tightly against the mold surface. This is a necessary requirement in holding close tolerances while producing good detail.

Table IV shows minimum tolerance requirements for parts with relatively thin wall or non-heavy sections. (Length to thickness ratios).

Table V shows minimum tolerance requirements for heavy sections or solid shapes within practical casting range.

Blind recesses or holes

Depth of a blind hole should not be greater than its diameter. A blind recess can be greater than its width provided it is well supported by fillets, etc. If recesses occur on two or more sides, some means should be provided for allowing the investment to fill all surfaces of the pattern. (Improvising break through areas by means of holes or slots).

Through holes

The minimum diameter of through holes which we have cast is .010" with a length of .040". Actually, though, the limitation involved is the size of a hole which will properly fill with investment or in the setting of a core. That is how small a core could be made in production and utilized in the investment process.

The approximate ratio of core diameter to length without setting of separately made ceramic cores is shown below.

up to /16" dia.—3 to 10 times the diameter
1/16" to 3/16" dia.—8 to 16 times the diameter
3/16" upward—10 or more times the diameter

With the use of ceramic cores set in the pattern, there appears to be little restriction as to the diameter to length ratio in the size range which we investment cast.

TABLE IV—TOLERANCES

General minimum tolerance requirement for parts with relatively thin wall or non heavy sections.

up to 1"	.004"
1" to 1½"	.006"
1½" to 2"	.008"
2" to 2½"	.010"
2½" to 3"	.012"
3" to 4"	.015"
4" to 5"	.020"

TABLE V—TOLERANCES

General minimum tolerance requirement for heavy section or solid shapes within practical casting range.

up to ½"	.005"
½" to 1"	.008"
1" to 1½"	.012"
1½" to 2"	.015"
2" to 2½"	.020"
2½" to 3"	.025"

Heat treatment

Heat treatment is not usually necessary due to the hardness of these alloys in an as-cast condition. However, alloy 148 can be solution heat treated up to 48 Rockwell C. Hardness is not a criterion with castings from these alloys however, as castings considerably softer than a file cannot be marked with one.

REED-PRENTICE

DIE CASTING NEWSLETTER

When rejects go up... check your gating and design first.

Gating of die casting dies is perhaps one of the most misunderstood aspects of the industry. While some experienced engineers can come up with a very good gating system after studying a casting, too often gate patterns just seem to "happen that way."

The reason: gating's function is misunderstood and thus misapplied.

Because die casting is a high-speed, high-production process, it is generally deemed desirable to keep the connection between the runner and the casting as small as possible. This makes degating an easier operation, one requiring unskilled labor.

Fact... and fiction

While ease of degating is a definite consideration, the most important aspect of gating a die casting die is to provide a metered entry of the metal, preventing its entering the die faster than air can be vented. For vents must be limited in size to an area no greater than will freeze off without splitting.

Gates are often used to try to build up pressure on the metal, but this is a fallacy. Pressure build-up occurs *in the runner*. No matter what the conformation of the gate, pressure in the casting does not build up *until* terminal filling has occurred.

Pity the machine

As far as the effect on machine performance is concerned, gating design can—and often is—carried to a ridiculous extreme. Gates are choked off with no consideration of the velocity of the metal, volume of metal, time of fill, or any factor except that the operator must be able to break the gate off by hand... quickly and easily. The machine is expected to have high speed, substantial pressure, and *lots* of it.

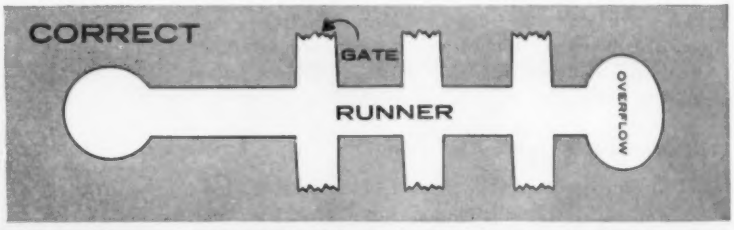
This is fine, but often it doesn't work. Too many castings have defects, rejects are up, and where do you place the blame? All too often, it's the machine's fault, or is it? Take another look at that gating design, and at the runners.

What runner pattern?

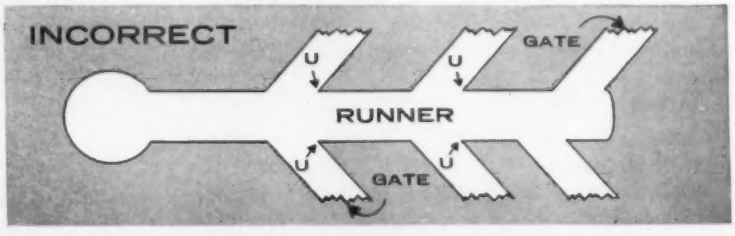
A runner is more than a means of conveying the metal to the gate. Consider it a high-pressure, smooth-walled conduit, with either a constant or reduced area that prevents expansion of the metal. Its size and conformation *are* important.

The simplified sketches here show a sound runner design and one other system which, though commonly used, tends to produce surface defects on castings.

If you are having casting trouble, why not check with your nearest REED-PRENTICE Sales Engineer. He'll be glad to consult with you.



With a straight runner, metal rushes to fill the overflow first, then the entire runner. It expands out from the center in a continuous flow, with equal force to both sides.



When a runner branches out at an angle, its upper edges (U) tend to catch a partial flow of metal. Small amounts are injected into the cavity before filling volume is available, causing a cold shot and rough, porous castings.

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Circle No. 65 on Reader Service Card

Preformed ceramic cores permit . . .

MORE COMPLEX HOLLOW COMPONENTS

By JOHN WEBB, *Technical Director, Sherwood Refractories Div. of J. J. Sherwood, Inc.*

This article on ceramic cores concludes the series begun in PMM April 1961 on page 46.

THE AVAILABILITY OF PREFORMED CERAMIC CORES offers a new freedom to the design engineer. With them he may:

- Consider in his design only the end use of hollow components without regard to coring restrictions.
- Specify thin walled sections of controlled thickness and/or uniformity.
- Disregard internal configurations as a factor in coring feasibility.
- Specify alloys without concern about metal-to-core reaction.
- Use alloys where machining is difficult or impractical.
- Design internal passages which do not lend themselves to machining.
- Substitute investment castings for fabricated hollow shapes.

The design advantages of performed ceramic cores can best be illustrated by comparison with conventional coring methods in common use.

Three coring methods are the most widely used:

1. PREFORMED CERAMIC CORES can be gauged for dimensional accuracy and surface finish before installing them in the die.

2. A CERAMIC CORE, after inspection, goes into the die for injection of wax or plastic to make the disposable pattern.

EVALUATE CERAMIC CORES WITH THIS TECHNICAL DATA

Dimensional Stability: Specified dimensions can be maintained within tolerances of +.005" or better, depending upon the type, size and configuration of the core.

Surface Finishes: Use of preformed cores assures an as cast surface finish of 100 RMS or better.

Casting Temperatures: Preformed cores are used regularly in production of various vacuum melted and vacuum cast alloys as well as all air-melt alloys used in the investment casting industry. Metal pouring temperatures in excess of 3000°F showed no adverse effects, deformation, or other type of deterioration of the cores.

Thermal Shock Resistance: Exceptionally resistant to extreme temperature fluctuations. Cores have been flash-fired without imparing core reliability.

Ceramic shell molds containing preformed cores have also been flash-fired without imparing the core reliability.

Fired molds may be stored until needed, without risk of deterioration of the core.

Compatibility: Through strict laboratory control, ceramic core materials may be compounded specifically to eliminate metal to core reactions with any common or highly reactive alloys.

Modifications in producing cores can be made to make them compatible with various mold processes.

Expansion Stability: Ceramic cores are generally unaffected by multiple firings and are substantially volume stable at all casting temperatures. Expansion data shown in Table I.

TABLE I—EFFECT OF FIRING

Degrees — F	% — Permanent Linear Change
1600°	±0.12%
1700°	±0.18%
1800°	±0.21%
1900°	±0.23%
2000°	±0.23%

Core Weights and Sizes: To date, the largest mass weight for a coring application, has been 3⅛ lb. total finished mass weight in a core for a missile component. The largest diameter called for has been a core 13.5" in diameter and weighing 1¾ lb. while the smallest core has been .060" diameter. Other cores of an airfoil contour have been produced successfully holding a pitch thickness of .340" contoured to a trailing edge thickness of .020" and tolerances held to ±.001".

Sagging: Due to the properties of the high temperatures core refractory materials and special processing techniques, sagging has presented no problems.

Preformed ceramic cores lend themselves to mass production technique, contributing to volume savings through cost reductions, higher yields in saleable castings, elimination of weldments and other allied machining costs.

1. collapsible metal cores inserted in the injection cavity and withdrawn in segments before the wax pattern is removed from the die; 2. multiple-component wax or plastic patterns joined together to form the complete hollow configuration; and 3. soluble wax cores positioned in the pattern die so that wax injected to make the pattern will surround the functional area of the core. When removed, the soluble wax leaves a hollow interior.

All three of these methods have a common disadvantage. They depend on filling the hollow sections with a mold slurry to produce the ultimate cores. It is impossible to inspect the cores for voids or blisters (the surface cannot be examined) and any inclusions will be reproduced in the casting.

In contrast, preformed ceramic cores can be minutely inspected before they are inserted in the pattern die. All surfaces can be examined and when necessary dimensional accuracy checked as shown in figure 1.

Once inspected they go into the pattern die, figure 2, and the wax or plastic injected and the mold made. When the pattern is melted out there is every assurance that the core will give the exact internal configuration wanted.

Another distinct advantage of preformed cores when compared with collapsible metal cores is the total absence of parting lines always present with metal cores of this type. No delicate trimming is required and cored holes located where machining is impossible will be true.

When compared with multiple component patterns welded or cemented together, preformed cores prevent possibility of dip-coat penetration into the

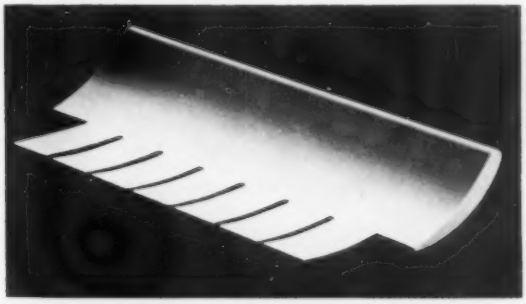
joint. They also eliminate a difficult and skilled assembly operation and avoid distortion of the wax.

Figures 3, 4, and 5 show some of the applications where preformed ceramic cores have made substantial contributions to component design and cost reductions. In each case the coring specialist worked closely with the design engineer in developing the final shape to give the best performance and alloy realistic production.

On page 54 is some of the technical data on preformed ceramic cores. For the most part, this data applies to Sherwood cores only.

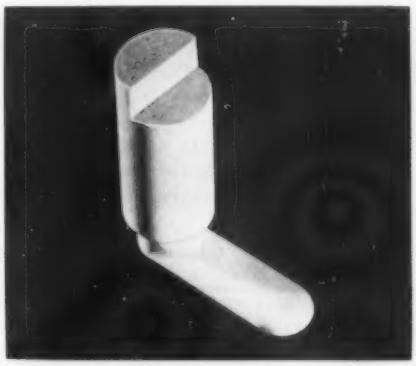
HERE'S HOW PREFORMED CORES HELP YOU DESIGN

3. CASTING originally required a two piece core, assembly, brazing and milling.



4. PREFORMED CORE made economical production of the casting in figure 3 possible.

5. BLIND HOLES and angular holes made coring difficult, internal blistering a problem.



6. INSPECTION after casting is impossible, and with preformed cores, not necessary.

7. CURVED CASTINGS make it impossible to detect or remove defects caused by mold breakthrough.

8. NO DESIGN COMPROMISES are necessary with preformed cores and production costs are low.

DESIGNING FOR POWDER

By T. L. ROBINSON,
President,
Powdercraft Corp.

A DESIGN ENGINEER'S NOTE BOOK

SPROCKETS

SPROCKETS FROM METAL POWDERS, for both roller chain and ladder chain, are much less expensive than cut steel sprockets. Their low cost permits a wide field of application.

With cut sprockets the unit cost goes up greatly with increased number of teeth. With powder metal sprockets there will be a small increase in original tooling charges, but no appreciable difference in unit price. The increase in tooling cost is usually modest enough so that the saving by converting to a powder metal part is not lost.

Choice of Materials

With cut sprockets the choice of materials is somewhat limited. Only the commonly available metals, steels, bronzes, brasses, and stainless steels can be economically used. With powdered metal parts any desired metal, alloy, or mixture of

TABLE I

MATERIALS STANDARD SINTERED 4630A ALLOY STEEL

1. This specification covers a material suitable for machine parts.
2. Chemical Composition:

Carbon	.30%	Manganese	.75%
Nickel	1.85%	Sulphur	.01%
Molybdenum	.25%	Phosphorus	.01%
Silicon	.35%	Iron	Balance

3. Physical Properties:

Tensile Strength (Ultimate) P.S.I.	40,000-60,000
Density	6.4 to 6.8
Hardness (sintered only)	55 Rockwell B
Hardness (sintered and heat-treated)	100 Rockwell B
Particle Hardness (by file test)	55 Rc Min.

4. This material is porous and hence when oil filled has self-lubricating properties.
5. It is used primarily for accurate, heavy duty parts, and to replace copper-infiltrated iron in applications where the characteristic distortion, surface defects and minimal oil retention of copper-infiltrated parts are handicaps.
6. This material may also be heat-treated by conventional quenching and drawing operations, further increasing strength and hardness, still with less distortion than copper-infiltrated iron.

MATERIAL STANDARDS SINTERED MEDIUM COPPER IRON

1. This specification covers a machinable material suitable for parts usually made from low carbon steels.
2. Chemical Compositions:

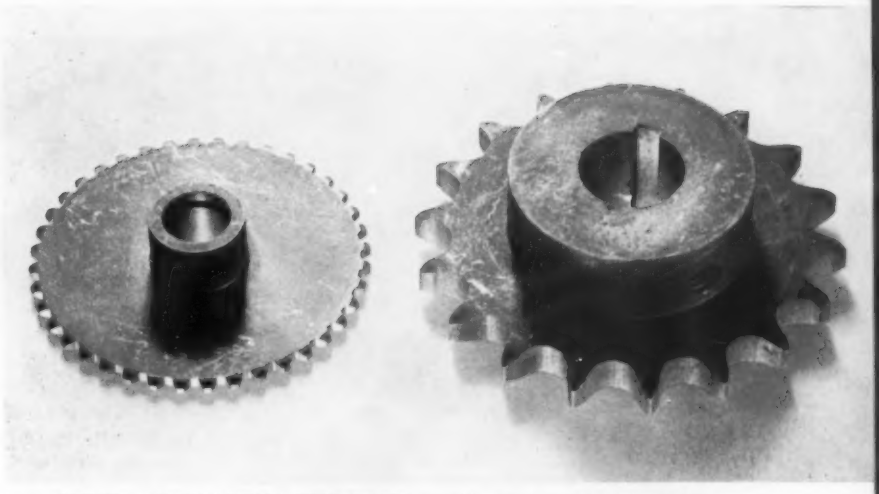
Iron	84% to 85%
Copper	14% to 15%
Carbon	0.5% to 1%

3. Physical Properties:

Tensile Strength (Ultimate) P.S.I.	37,000
Elongation Min. (% on 2" length)	4-5
Compressive Strength (for .001" set)	47,000
Brinell Hardness (Apparent)	50-70
Porosity (%)	15-20
Specific Gravity	5.8-6.4
Density (lb/cu.in.)	.22
Coeff. of Thermal Expan. (in/in/°F)	.000008
Electrical Conductivity (% of Cu.)	7.5

4. This Powdercraft material is porous and hence when oil filled has self-lubricating properties.
5. It is used primarily in parts which require some machining after sintering.
6. It can be furnished processed for plating or case hardening.

METALLURGY



1. **POWDER METALLURGY SPROCKETS provide long service life at low first cost with adequate strength.**

metals can be used. For special purposes it is even possible to use mixtures of metals and non-metals. This wide latitude of materials permits fabricating sprockets of specially prepared mixtures for little more than the added cost of materials. Two widely used compositions are given in Table I.

Where not to use them

In some cases, and these are a minority, sprockets with roller chains are used on heavily loaded, high speed, constant duty applications such as machine tools. Powder metal sprockets would probably not be used there. Also on slow moving conveyor systems where a cast sprocket is adequate, the saving with powder metal parts is dubious.

Where to use them

The vast majority of sprockets are used in medium to light duty applications. These would include farm equipment, lawn mowers, chain saws, moving picture projectors, and a host of similar equipment. For these applications powder metal sprockets are generally adequate and much less expensive than cut ones.

The one exception in the heavy duty field may be chain-type flexible couplings. In this group, while the total loading is high, the load is evenly distributed over all of the teeth and powder metal sprockets have been used satisfactorily.

Two typical steel sprockets are shown in figure 1.

One of the advantages is self-lubrication. This is characteristic of powder metal parts. It is a difficult factor to pin down except by careful testing in actual service, but there apparently is an increase in surface slide due to self lubrication.

As a general design figure, it is safest to assume that powder metal steel sprockets will carry about one-half the load that a machined, wrought steel sprocket of the same chemistry and hardness will carry. But at the same time, remember that a powder metal sprocket will cost about half as much as a machined one.

With this margin to work with, redesign of the sprocket, even if it means higher tooling costs, may be very worth while. For example, by increasing the number of teeth on the sprocket the load per square inch of tooth cross section can be materially reduced. This is a linear relationship with the unit load inversely proportional to the number of teeth in contact with the chain. If the tooth size must be maintained constant this will require a sprocket of increased diameter.

Where it is impossible to increase sprocket diameter, the same effect can be secured by increasing the thickness of the sprocket. Here again the same inverse ratio will hold, but a wider chain will have to be used.

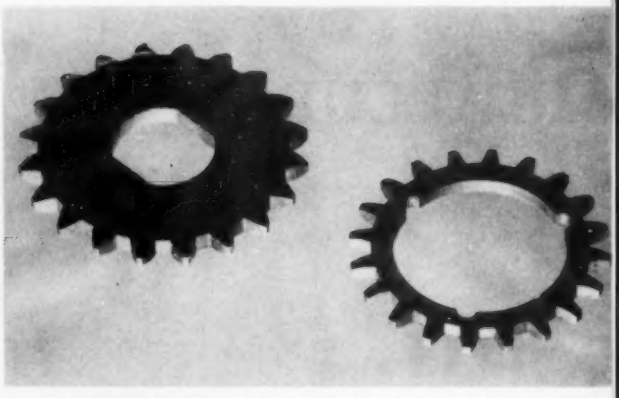
A third possible method to overcome the lower load carrying capacity of the powder metal sprockets, is to put an idler sprocket into the transmission. This, in effect, increases the wrap on the number of teeth carrying the load and has much the same effect as an increase in diameter of the sprocket.

Finally, and possibly the best solution, is to determine the *real* load per tooth. For medium and low power transmission it will usually be found that a cut, wrought steel sprocket is considerably over designed and a material with 50% the load carrying capacity still is adequate.

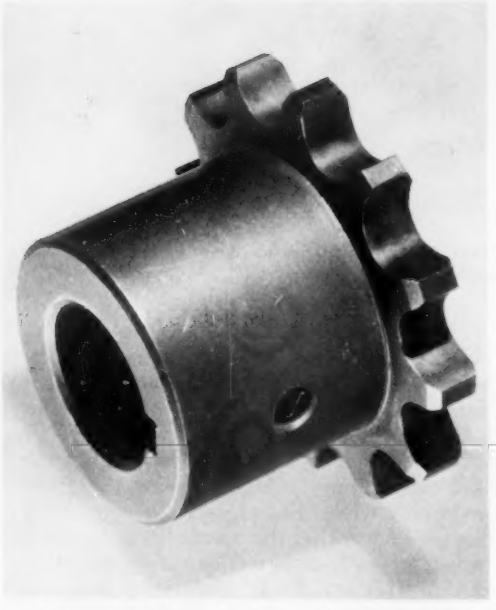
Another application of powder metal sprockets, even in heavy duty applications, is for idler sprockets. These are commonly employed simply to take up slack or increase wrap in the chain and carry no appreciable load.

There are, of course sprocket applications for which metal powder parts are well suited.

Almost any iron base powder metal part can be hardened. If only wear resistance is required a carbonitriding treatment may be all that is re-



3. NON-ROUND HOLES for firm locking on the shaft are easily made at low cost.



2. HARDENED high strength teeth with a softer oil impregnated core can be made.

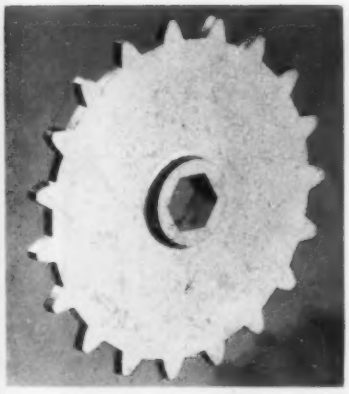
5. SPECIALLY DESIGNED hubs can combine different parts, allow multiple use of the sprockets.

quired. For the higher strength applications alloy steel powders can be employed and these may have the teeth induction hardened, figure 2, or the entire sprocket may be hardened. Infiltrated materials in which almost all of the pores in the normal powdered metal part are filled with copper can give sprockets of very high mechanical strength. When these parts are precipitation hardened, ultimate tensile strengths well in excess of 100,000 psi can be gotten. However, with infiltrated parts, all self lubricating properties are lost and the cost of the part will be increased by about 25%.

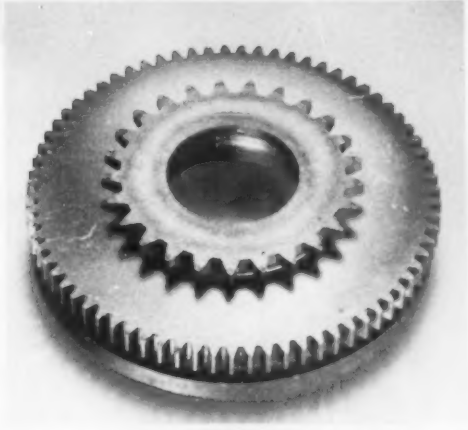
What has been said thus far applies mostly to steel sprockets. There are innumerable applications where brass, bronze, nickel silver, or some other non-ferrous metal is required or desirable. For example, on motion picture projectors and cameras, nickel silver is used for appearance and corrosion resistance. These sprockets are very lightly loaded and powder metal parts have adequate strength. Here the saving through the use of powder metallurgy is marked.

In general it is best to assume that with bronze, brass, and nickel silver, the load carrying capacity is from one-half to one-third the capacity of a cast and machined sprocket. Generally, figure from 12,000 to 15,000 psi for the powder metal part. However, in these applications we usually find ladder chains so that load need not be considered.

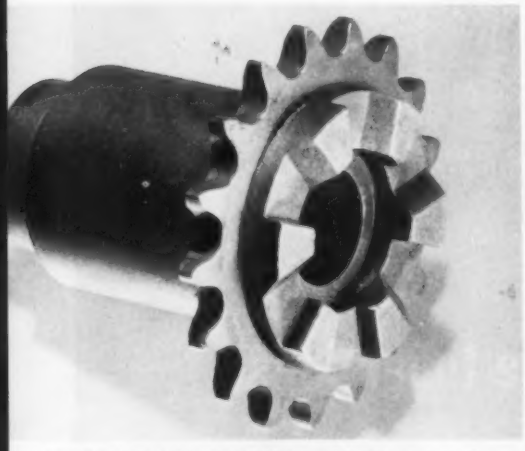
In many applications it is common to extrude a non-ferrous metal, usually brass or bronze, to secure long lengths of stock with the required outside contour and size. Slices taken from such a bar are then used as sprockets. This method of manufacture has many manufacturing economies, but requires a lot of machine work and assembly. The sprocket must be bored to accept a hub, the hub made from separate stock, usually screw machine work, and the two pieces assembled. Or as an alternative the piece of extruded stock is cut thick enough to permit machining a hub out of the extrusion. In either case, there is a high machining and assembly cost and a large material waste. In almost all cases where this procedure is fol-



4. SHARP EDGES are made without machining.



7. ONLY very expensive machining could make these steel parts—unless powder metallurgy is used.



6. SPROCKET AND CLUTCH combinations are only one of the many savings possible.

lowed a powder metal sprocket can be used, and at a considerable cost reduction.

Another of the outstanding advantages of powder metal sprockets is the ability to mold-in keys, key-ways, and other fastening devices. When the key is an integral part there is a saving not only of a separate piece, but also the cost of handling the key. The hole need not be round. A small increase in original tooling will provide almost any shape hole desired to give a strong, positive drive. Examples of specially shaped holes are shown in figure 3. These avoid expensive broaching.

Specially designed hubs can be formed easily. For instance, in figure 4, an extra long hub has been molded on the sprocket. Here, a one-piece structure replaces a conventional sprocket and spacing collar. The cost is increased only by the amount of additional iron powder required to form the longer hub. Often, when hubs of varying length are required, there is not even an additional tool charge. Many variations can be accommodated by press adjustment only. However, spacers in the die can be used to vary the depth of fill and hence the hub length.

Another outstanding advantage of powder metal sprockets is the combination of two or more parts into a single unit, see figure 5. For example, it is common to find a combination of parts which might include a dog clutch, a sprocket, and several bearings. With powder metallurgy, the sprocket, one half the clutch, and a bushing can be in incorporated into a single powder metal part. Separate machining, possibly a welding or brazing operation, and certainly an assembly operation, are all eliminated. For medium and light load applictions adequate strength, hardness, and impact resistance can be provided.

Only some of the most general design considerations have been noted. It is wise to consult with a qualified fabricator of powder metal parts during the design stages. Frequently minor design changes can be made which will result in major manufacturing economies.

Part II of this series will appear next month.

Madison-Kipp zinc and aluminum die castings

These five castings assembled in the order that you see them are engineered for a radial arm saw. Intricate in design, they must match perfectly and that means extremely close tolerances. Mass production demands a minimum of secondary operations.

This is just one example of the wide range of castings that Madison-Kipp is called upon to engineer and produce—in quantity. All, however, have one thing in common—the need of a dependable source with years of seasoned experience in producing die castings.

We have a 24-page book showing some of the die casting problems we have solved, and containing information on other Madison-Kipp products. A copy is yours for the asking. Write for one.

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Design tips for using

PORCELAIN-ENAMELED ALUMINUM EXTRUSIONS

Where can porcelain enameled aluminum extrusions be used? Almost anywhere that color, wear-resistance, corrosion resistance, and almost indefinite life are wanted in addition to the light weight, ease of extrusion, and other advantages of aluminum. For example:

- *Trim on most home appliances*
- *Furniture hardware*
- *Business machines*
- *Architectural products*
- *Sporting goods*
- *Optical goods*
- *Scientific instruments*
- *Special machinery exposed corrosive atmospheres*
- *Special machinery requiring superior wear resistance*

PORCELAIN-ENAMALED ALUMINUM now offers the engineering designer the greatest flexibility he's ever had with this type of finish. For the first time, extruded aluminum shapes can be porcelain-enameled. Although there are some limitations on complicated cross-sections or long hollow forms, most shapes can be coated with no trouble.

Extruded shapes, coated with porcelain enamel, give a product with all of the advantages of aluminum, plus durable, trouble-free color; added corrosion resistance; flexural strength; fire resistance; and high dielectric strength. They can be sawed, drilled, welded or fastened with screws.

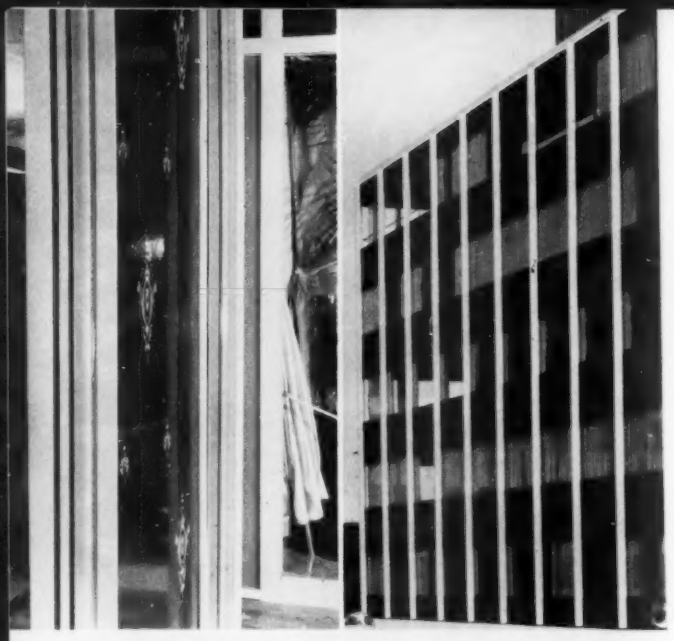
Porcelain enamel has been decorating metals for over 3000 years. But some of the biggest advances have taken place in the last ten, such as production of enameled aluminum permanent mold castings (since 1951),[1] and now aluminum extrusions.[2]

Architects have been the first to make extensive use of porcelain-enameled aluminum extrusions. Ideal for trim and for narrow mullions (vertical strips between windows), colorful shapes have been used as decorative structural members on large and small buildings.

Door frames, sash and window frames, and metal furniture are other examples of good design use of porcelain-enameled aluminum extrusions. Bright and colorfast after many years of service (it washes clean like glass, because it is glass), porcelain

(1) *Vitrious Enamel for Aluminum Permanent Mold Castings, PMM, April, 1955, pg. 60.*

(2) *Porcelain Enameling on Aluminum, PMM, April, 1960, pg. 55.*



ARCHITECTURAL DESIGNERS use aluminum extrusions to add strength and light weight. When parts are porcelain enameled, color is added as well as long life.

enamel is a choice worth considering for any product that's meant to last for years.

In a breakthrough to a new area, one manufacturer of office machinery has specified small enameled aluminum extrusions for their chemical and heat resistance.

Fabrication

Unique among porcelain-enamel products, aluminum can be cut, sawed, or drilled, without fear of damaging the coating. The lead-bearing porcelain enamels are so adherent to the aluminum, that spalling from a cut or damaged edge just doesn't occur.

Aluminum itself is also highly corrosion-resistant, so there is no danger of rust or unsightly corrosion products forming at the exposed areas.

This means that, unlike other porcelain-enameled products, when using aluminum you can cut parts and drill and tap all fastening holes directly in the porcelain-enameled extruded stock. In building construction, panels can be fabricated right on the job.

Welding and joining

There are few design limitations to joining methods. Enameled aluminum extrusions can be welded, brazed, soldered, or fastened with screws.

An uncoated flange or underside of an enameled extrusion can be welded without discoloring or damaging the coating. The same welding techniques used for plain aluminum extrusions may be used for enameled shapes. In fact, even the reverse side of a thin enameled sheet can be welded without damage, if the operator is careful.

Enamel can be applied right over a welded area that has had the proper surface treatment. If enameling is contemplated, type 4043 welding rod and inert gas should be used. The weld should then be sandblasted, and this followed by a long and strong cleaning treatment in a caustic etchant.

Applying enameling after soldering or brazing usually won't work, as the melting points of most solders and brazing materials are below the maturing temperature of the enamels.

Design factors

The Porcelain Enamel Institute recommends type 6061 alloy for porcelain-enameled extrusions. Very few limitations are imposed on the cross section shape by the porcelain-enameling process. Limitations that do exist are due to the low mechanical strength of aluminum at the enameling temperature.

Thin-walled extrusions requiring large overhanging tongues will present a problem to the enameler. These shapes often will distort during firing, particularly if the thin section is adjacent to a much thicker section. Differences in heating and cooling rates cause the trouble here. However, enameling of both sides tends to lessen warpage.

Flanges and angles are advantageous to the design, acting as stiffeners which strengthen the metal at firing temperatures.

When mated extruded sections—dovetail, contact, contour, snap or sliding fits—are designed, allowance for enamel thickness must be made in the die itself. Nominal thickness is usually 4 mils. If the extrusions can be sprayed with automatic equipment, allow a tolerance of ± .5 mil, so final thickness is 3.5 to 4.5 mils. With manual spraying, the tolerance is ± 1 mil, and final thickness is from 3 to 5 mils.

Carbon and other foreign matter must be removed from the surface before enameling. All corners and fillets should have a minimum radius of 1/16-inch, to prevent enamel burns and build-up of the coating.

Check with enamelers, such as Du Pont's elec-

Continued on page 64

SOME REPRESENTATIVE FRIT COMPOSITIONS FOR ALUMINUM

(Composition given in weight percent)

PbO	38.1	34.7	35.4	36.4	42.5
SiO_2	25.3	31.5	23.4	34.9	28.2
Li_2O	2.2	2.6	2.0	2.2	2.4
Na_2O	10.2	11.1	9.5	13.4	9.8
K_2O	8.3	8.1	7.7	2.2	7.4
TiO_2	8.7	10.7	8.1	9.3	9.7
Sb_2O_3	2.9	—	1.8	1.6	—
B_2O_3	4.3	—	4.0	—	—
ZrO_2	—	1.3	—	—	—
CdO	—	—	8.1	—	—

Porcelain enamels for aluminum differ from conventional porcelain enamels for steel in two significant ways:

1. Firing temperatures are 500°-600°F lower (920° to 1020°F).
2. Coefficient of thermal expansion are considerably higher (14 to 18 x 10^{-6} in/in/deg.C.)

Here are tips to help you achieve packing-fluid compatibility!

The efficiency, safety and ultimate cost of a hydraulic system is largely dependent on the compatibility of its packings and fluid medium . . . how well they do or do not work together.

Mineral Oils

The above is frequently overlooked when a plant switches from one type of fluid to another. Take *mineral oils*, for example. Three general types are used in hydraulics, and are classified according to their aniline points: high, medium and low.

If, through error, a high aniline oil is used where low aniline oils are specified, rubber seals in the system would shrink and harden. Conversely, "high aniline" rubber seals will swell and soften in low aniline hydraulic oils. Leakage or equipment failure is the result.

To complicate the picture further, mineral oils made to the same specification by different oil manufacturers, using different crudes, will vary in aniline point to the degree that they may cause synthetic rubber seals to either shrink or swell.

Even among the various types of synthetic rubber used for hydraulic seals, the reactions to mineral oils vary. Buna S and Butyl seals, for example, will disintegrate in mineral oil while Buna N, Neoprene, Viton and Thiokol polymers work very well.

Fire-Resistant Fluids

In many hydraulic systems, *mineral oils* are being replaced by modern, synthetic fluids which eliminate fire hazards without affecting hydraulic efficiency.

Three types of fire-resistant fluids are in wide usage and each type requires a *compatible* packing.

The three basic types of synthetic fluids with *recommended* and *maximum recommended* operating temperatures are shown in the box.

Type	Recommended Temperature	Maximum Recommended Temperature
Phosphate Ester	+130°F.	+180°F.
Water-Glycol	120°	150°
Emulsion water-oil	120°	150°

Phosphate Ester fluids and mineral oils have a directly opposite effect on the same rubber seals. Butyl packings which fail miserably in mineral oils, work beautifully with straight Phosphate Ester while Buna N, which works well in mineral oils, is unsuitable for Phosphate Ester. For this reason, changing a system from mineral oil to Phosphate Ester requires a complete and careful flushing and cleaning *as well as a switch in packing materials*, if elastomer packings are used.

For use with these fluids, homogeneous packings should be of Butyl, fabricated packings of Butyl and duck or asbestos and leather packings should be either Wax or Thiokol impregnated.

Water-Glycol fluids are generally compatible with both Buna N and Butyl seals, and with duck or asbestos. However, they do attack leather fibers. Water-Glycols have a pH of 8.5 to 10.5 and leather fibers start to disintegrate at a pH over 8.0

Because of this pH condition, leather packings are not recommended for use with Water-Glycols. Homogeneous packings should be of Buna N and fabricated packings of either asbestos or duck and Buna N.

Emulsion type fluids react much the same as mineral oils do with rubber and leather. In homogeneous and fabricated packings, use Buna N; in leather, use a filler of wax or Thiokol. Never use Emulsion fluids with Butyl.

A Simple Solution

As complex as the subject appears, packing-fluid compatibility in hydraulic systems can be determined with very little trouble. Houghton Packing-Fluid Compatibility Tables will instantly tell you which packings work best with the various types of fluids in general use.

Better yet, Houghton is in a unique position to give you completely unbiased answers to your hydraulic packing-fluid problems, for **Houghton is the only manufacturer who offers you a complete line of both packings and fluids for industrial hydraulic systems.**

FREE! Packing-Fluid Compatibility Tables

For your copy of Houghton's Packing-Fluid Compatibility Table, or for help on any hydraulic packing or fluid problem, call your Houghton representative or write: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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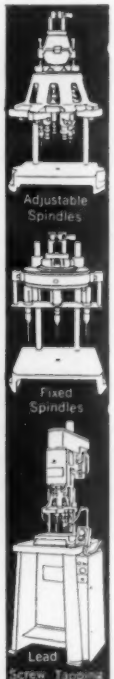

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ALUMINUM EXTRUSIONS

trochemicals group (Wilmington) or Ferro Corp. (Cleveland) for specific information.

Surface finish

Aluminum porcelain enamels are applied in very thin coats and don't have the flow characteristics of conventional steel enamels. As a result, all surface marks will show through the enamel.

Therefore, extruded shapes should be as free of die lines as possible. Also, careful handling of the raw aluminum stock is very important.

Scratches will appear usually as a series of bubbles or thin depressions in high gloss coatings. Rough surfaces such as a sandblasted surface are impossible to cover with a smooth coating.

Light scratches can be removed in a caustic cleaner. Deeper scratches must be ground out first with 80-grit disks, then finished with 180-grit disks; then the grinding marks are etched out in the cleaning tank.

Brake press lines can be removed the same way.

Properties of Porcelain Enamel

- **Appearance.** There is practically no limit to the variations in light-fast enamel colors, from brilliant hues to delicate tints. Textures such as stippled, mottled, and rippled finishes can be had. Almost any degree of surface reflectivity is possible, from dull matte to high gloss.

- **Durability.** The properties of glass provide long life at low maintenance cost. Some field installations of porcelain-enameled aluminum have been in service more than ten years, with no deterioration of any kind discernable.

- **Chemical Resistance.** Enameled aluminum is highly resistant to acids, alkalis, and sulfides. The Porcelain Enamel Institute's acid durability rating in Class A for whites and pastels, Class B for colors. The enamel doesn't stain, streak or fade on exposure to strong detergents. Surfaces have shown no sign of deterioration after 480 hours in a 20% salt spray.

- **Impact Resistance.** In standard tests, samples averaged five impacts before loss of coating. No sharp edges, progressive spalling or flaking occurred.

- **Thermal Shock Resistance.** In tests, panels heated to 1000° deg F and plunged into cold water showed no cracking or flaking.

- **Thermal Stability.** Porcelain-enameled aluminum can be heated to within 300°F of the firing temperature without damage to the coating. (Firing temperatures are 920° to 1020°F.) Dry cold and freezing temperatures do not affect it, nor does alternate freezing and thawing in the presence of moisture.

- **Abrasion Resistance.** The present lead-bearing enamels for aluminum are not resistant to abrasion as conventional steel enamels, but they are ten times more resistant than normal alkyd-amine paint, according to PEI.

new products & developments

Continued from page 21

Tandem cylinders

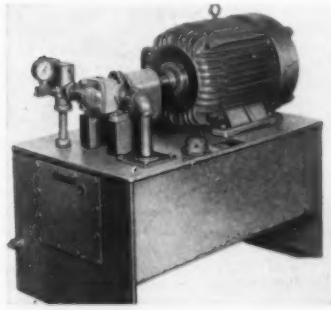
ALLENAIR CORP.—Type BVT valve-in-head tandem cylinders combine all the advantages of

valve-in-head cylinders with those of hydraulic control of an air operated cylinder. They are available in bore sizes from 1½" to 80".

Circle No. **238** on Reader Service Card

Pump power unit

HANNIFIN CO.—1,000 and 2,000 psi single pump hydraulic power units have reservoir capacities



from 15 to 60 gallons. A conversion feature for 11 pumps of the 13 pump series allows the buyer to increase working capacity by adding a greater horsepower motor at a later date.

Circle No. **239** on Reader Service Card

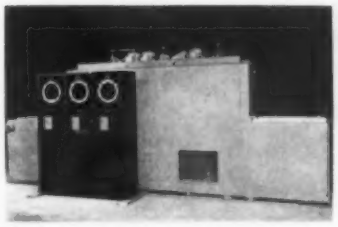
Die lubricants

CHEM-TREND—New die casting lubricants are produced as clear solutions. This makes possible unlimited storage stability. The lube cuts finishing operation problems, is equally effective for aluminum, magnesium and zinc, and is available for solvent or water dilution.

Circle No. **240** on Reader Service Card

Heat-treating furnace

WALTZ FURNACE CO.—Drawing furnace accommodates three work baskets. Automatic push-



ers load and unload the baskets. Maximum temperature is 800°F.

Circle No. **241** on Reader Service Card

more New Products on next page

NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW! NEW!

LESS HANDLING — FASTER OUTPUT
LOWER COST WITH THESE *SYNTRON*

VIBRATORY

BARREL FINISHING MACHINES

A NEW CONCEPT IN PARTS FINISHING!

NEW HIGH SPEED, COMPACT ELECTROMAGNETIC UNITS

—produce 3600 controllable vibrations per minute creating a gentle and total agitation between the parts and media. Finish delicate, difficult, or heavy parts faster at lower costs.

The simple electromagnetic design assures fast, effective, dependable action and low maintenance.

LOADING
Fast, easy! Inspect parts while work cycle continues.

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One control to vary amplitude.

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Connect hose; flush out compound.

Unretouched photos demonstrate results!

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Parts Feeders

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Circle No. **71** on Reader Service Card

FOR DESIGNERS AND PRODUCT PLANNERS

*PDCS
*PROTOTYPE DIE CASTING SERVICE

ANSWERS ALL THESE PROBLEMS

If part of the product you are planning is to be a die casting . . . PDCS holds the solution to situations like these . . .

Your customers want samples of your product and you need die castings to complete your samples.

You must test the function of a new assembly which includes a die casting.

You are required to test the strength of a die casting as applied to your needs.

You want to judge the "feel" or appearance of a die casting before final specification.

You must hold down the cost of new product development by avoiding expensive design errors.

You are interested in market testing the sales appeal of a new product and die castings are required to build the needed samples.

PDCS is a newly developed process for creating production-like die castings, in small quantities, at low cost, without permanent tooling charges. Find out for yourself how PDCS can help you by filling out the coupon below and mailing it today.

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430 Third Avenue
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NEWTON NEW HAVEN

CUSTOM PRODUCERS OF DIE CASTINGS

I have a problem to which PDCS may be the answer. Without cost to me or my company . . .

☐ **Prints** ☐ **Models** ☐ **Sketches are being forwarded under separate cover. Please submit your cost estimate.**
☐ **Have your representative call.**
☐ **Send me your free folder, "PDCS . . . Prelude to Production".**

A

NAME:_____
TITLE:_____
COMPANY:_____
ADDRESS:_____

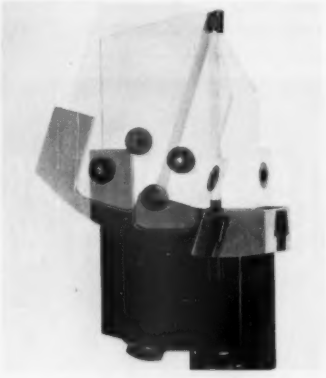
Circle No. **55** on Reader Service Card

new products & developments

Continued

Adjustable cut-off tool

PORTAGE DOUBLE QUICK, INC.—Manchester adjustable rake angle tool eliminates design of



special tooling and special insert grinding for different rake angle requirements. Use it on lathes and cut-off machines.

Circle No. **242** on Reader Service Card

Metal cleaning and surface treatment

OAKITE PRODUCTS, INC.—HD 126 cleans and treats metal surfaces, is safe on steel, brass and magnesium but not recommended for aluminum and zinc. Barrel cleaning before plating is one way to apply it.

Circle No. **243** on Reader Service Card

Belt lubricant

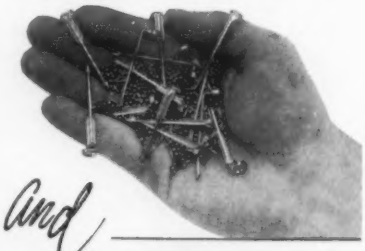
AMERICAN BUFF CO.—No. 371 polishing lubricant keeps belts open and free cutting at all times. Belt life is increased from 20% to 120%. It penetrates alkaline cleaners and vapor degreasers.

Circle No. **244** on Reader Service Card

more New Products on page 68

PARKER PEN MAKES A POINT:

the importance of proper finish . . .



and how ABBOTT helps to get it

Throughout the world, a Parker Pen is quickly identified by its distinctive arrow clip. Even while clasping firmly to a coat or shirt pocket, the clip properly signals the prominent Parker name . . . in some Asian countries, it's a status symbol and a mark of the wearer's literacy!

For these and similar reasons, the clip must **always** retain a gleaming, jewel-like finish . . . a finish durable enough to withstand the roughest everyday abuse . . . a finish that has no microscopic rough edges to snag or fray pockets.

To give the clip just such a finish, Parker uses Abbott steel burnishing media in vital tumbling operations. Besides producing the lasting, polished finish, the high-quality Abbott shapes increase the clip's surface hardness by compressing and compacting the grain structure of the metal.

What's right for your product . . . **finish or cut?** Send us a product or part sample. Without charge, we'll test it thoroughly and return useful recommendations promptly.

REQUEST BULLETIN AP-1 AND SAMPLE SHAPES

THE ABBOTT BALL COMPANY
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ABBOTT *the Leader since 1909*

Circle No. **1** on Reader Service Card
PRECISION METAL MOLDING

PMD . . . and the Direct Chill casting method

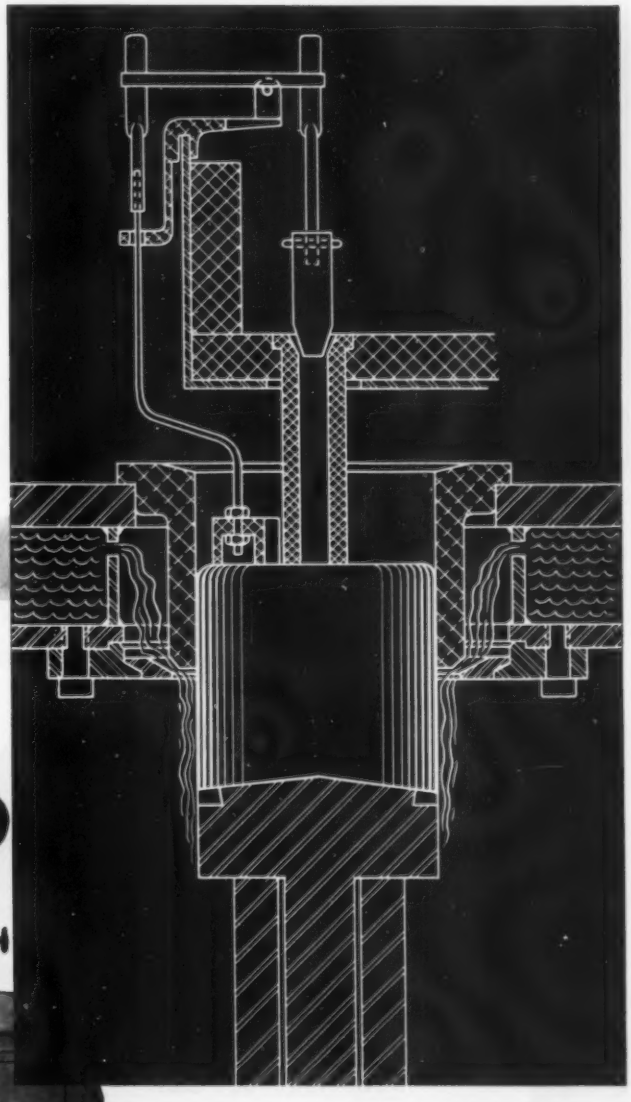
FOR CONTROLLED CASTING OF NON-FERROUS BILLETS

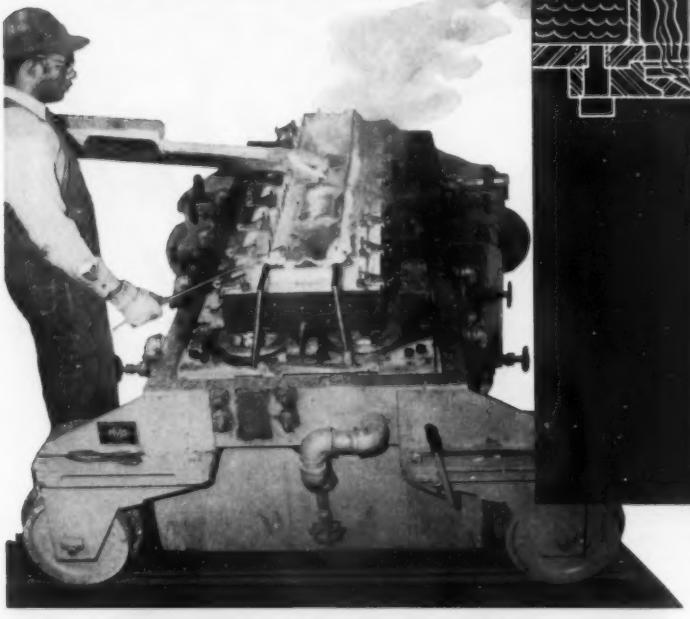
The direct chill method of casting has practically eliminated all of the objectionable defects that are present in most static castings. Because of the controls available to vary the casting conditions, billets cast by this method are particularly sound and free from segregation, porosity, and inclusions. Grain size and structure can be controlled or varied for different applications.

Direct chill casting is accomplished by pouring molten metal into an open end, water cooled mold that is closed at the bottom by a movable block. As the metal solidifies sufficiently to form a skin, the bottom block is lowered at a controlled rate and the direct chill casting is in process. A wide variety of shapes and forms is possible to cast in bar lengths replacing individual castings, resulting in considerable savings in machining and fewer rejects because of casting flaws.

Permanent Mold Die Company is a pioneer in the direct chill casting process. Through the research facilities of PMD, better casting methods are constantly being devised . . . methods that insure higher quality castings at lower costs. And remember, a Permanent Mold Die Co. engineer is available to anyone having die casting or tooling problems.

WRITE TODAY FOR DESCRIPTIVE BROCHURE





PMD

PERMANENT MOLD DIE COMPANY

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Circle No. 48 on Reader Service Card

POWDER CONDITIONING AND PROCESSING

METALLIC AND NON-METALLIC POWDERS GROUND TO YOUR SPECIFICATIONS

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- FERRO PHOSPHOROUS
- FERRITES
- MILL SCALE
- COPPER
- TUNGSTEN
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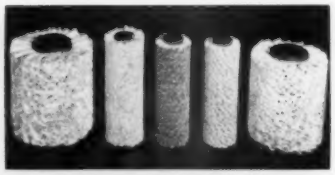
Member Metal Powder Ind. Fed.

new products & developments

Continued

Metal finishing buffs

GEO. R. CHURCHILL CO., INC.—Spyrl-Roll buffs eliminate streaking of metal surfaces and increase production because of their cutting action. Cloth or sisal buffs are available in various densities.



Circle No. 245 on Reader Service Card

Metal cleaner

THE DIVERSEY CORP.—F-72 compound protects against corrosion on iron, steel and other ferrous alloys. The compound is used as a paint base and has exceptional cleaning and phosphatizing action, all in one operation.

Circle No. 246 on Reader Service Card

Dust Collector

AGET MFG. CO.—Dust collection with Dustkop collectors is simplified with a new attachment. It catches dust in 55 gallon drums.

Circle No. 247 on Reader Service Card

more New Products on page 70

This DOLLIN Trademark
assures
TOP VALUE
in DIE-CASTINGS!
★ EFFICIENT DESIGNS
★ ECONOMICAL COST
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★ DEPENDABLE DELIVERIES
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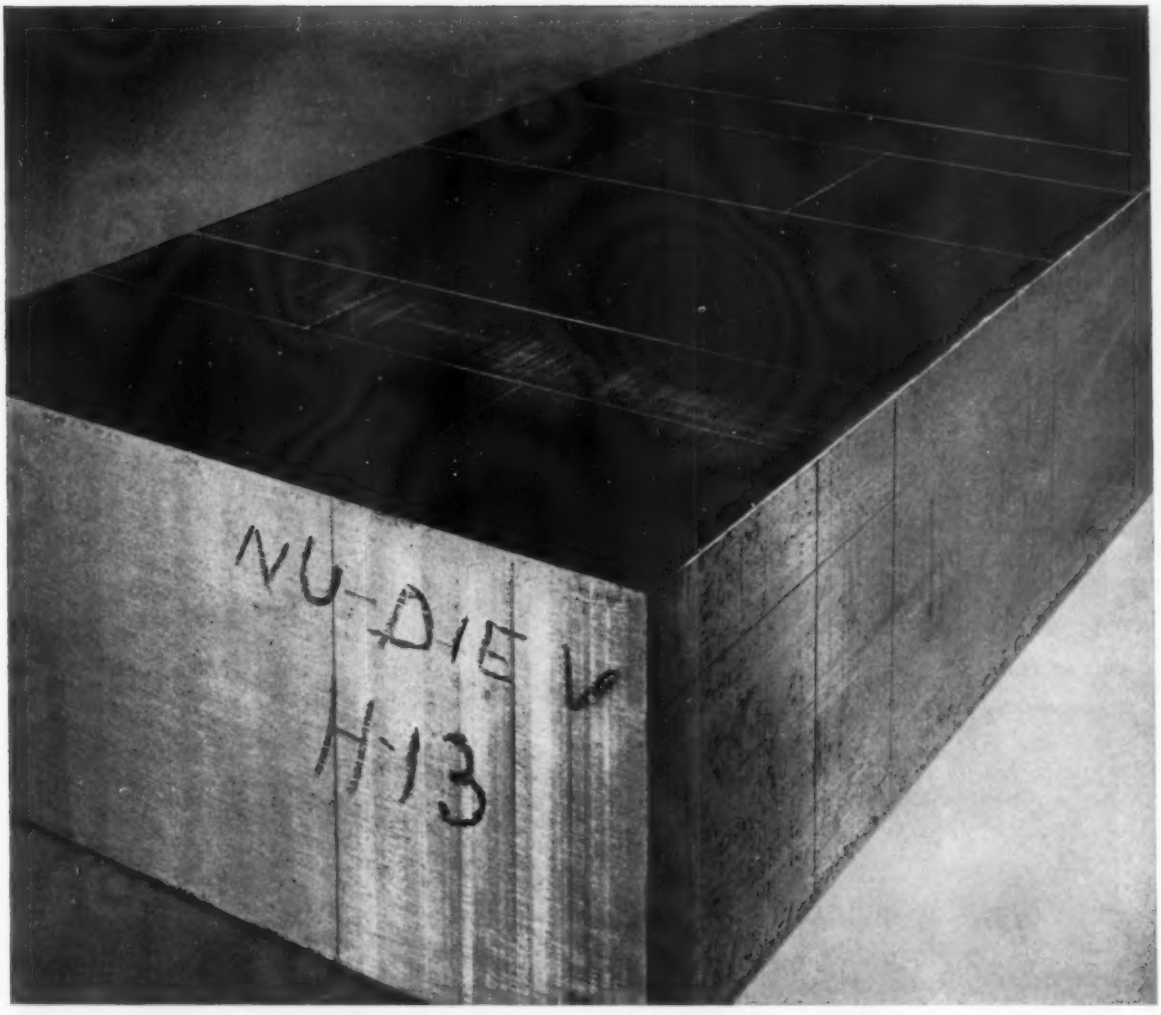
See "Yellow Pages" for nearest office.
DOLLIN Zinc and Aluminum DIE-CASTINGS

Circle No. 22 on Reader Service Card



every surface—die quality . . .

because **DENSIFIED** NU-DIE V is more uniform throughout the cross section

A new Crucible process—DENSIFYING—sets NU-DIE V apart from other H13 steels. *Densifying* benefits you in four major ways: *1.* It permits you to use larger sections with greater assurance of sound centers. *2.* It enables you to produce dies with even better finishes. *3.* It makes your dies less susceptible to washing and cracking. *4.* It also speeds deliveries of your die blocks because NU-DIE V now eliminates the need to specify individual forgings.

The DENSIFYING process, developed by Crucible, involves more than the normal consideration of steel analyses and amount of reduction. It includes careful appraisals of ingot size and shape, processing temperature control, and special methods of reduction. Only Crucible successfully combines all these techniques to produce this more uniformly *dense* Type H13 steel.

For more information on DENSIFIED NU-DIE V or CSM 2 die steels, call your local Crucible steel center.

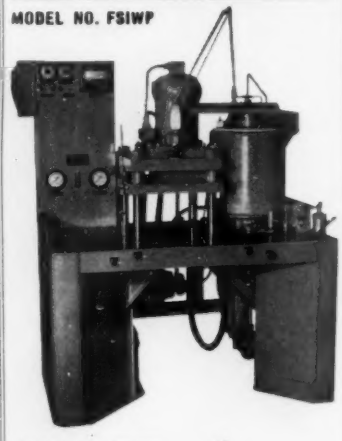
Crucible Steel Company of America, Four Gateway Center, P. O. Box 88, Pittsburgh 30, Pennsylvania.

CRUCIBLE STEEL COMPANY OF AMERICA

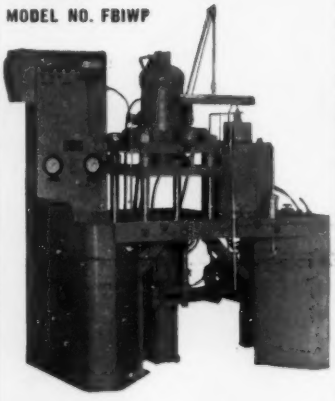
Circle No. **16** on Reader Service Card

NEW
WAX INJECTORS
3½ lb. CAPACITY ON STANDARD MODELS

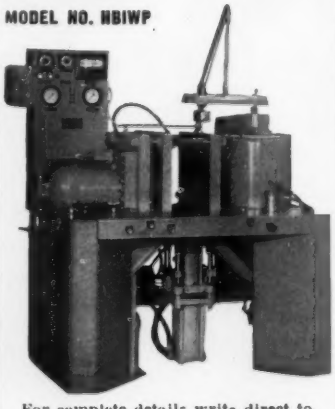
MODEL NO. FSIWP



MODEL NO. FBIWP



MODEL NO. HBIWP



For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.

1800 North River Rd. • Melrose Park, Ill.

new products & developments

Continued

Drill press

THE ELECTRO MECHANO CO.—Model 605 production drill press has variable speed control with no belt shifting, and speed range of 600 to 4,000 rpm. It has a time saver depth stop.

Circle No. **248** on Reader Service Card

Tool steels

VANADIUM-ALLOYS STEEL CO.—Ohio Die grade tool steel comes in flats and squares for maximum resistance to wear and abrasion. It is a high chromium die steel (AISI Type D-2).

Circle No. **249** on Reader Service Card

Aluminum etchant

THE DIVERSEY CORP.—A highly alkaline aluminum etchant, D-Etch, produces fine grain surfaces for decorative purposes. The etch also has special chelating agents to prevent sludge and scale.

Circle No. **250** on Reader Service Card

Extrusion quenching

AMERICAN MACHINE AND METALS, INC.—Quenching aluminum extrusion as it leaves the die is done with a high velocity stream of air water vapor mist, accomplished by a nozzle attachment on a fan. It eliminates bulky equipment and saves time.

Circle No. **251** on Reader Service Card

more New Products on page 72

SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC **ZINC**

SPECIAL HIGH GRADE 99.995% +
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Circle No. **36** on Reader Service Card

Make A.W. your iron powder headquarters

The new Alan Wood direct reduction plant employs the industry's most advanced technology.

From it comes Iron Powder with purity and uniformity that offers you new design flexibility . . . new fabricating possibilities . . . products of superior quality, closer tolerances at reduced production costs.

Behind this modern fifty-ton-a-day facility are many years of metallurgical research and pilot plant operation. Within its complete laboratory facilities, a continuing program of application investigation and analysis helps customers improve their production operations.

A.W. Iron Powder can be *custom blended* to your most exacting specifications.

Make Alan Wood your Iron Powder Headquarters. You'll like the prompt deliveries and the helpful Customer Advisory Service.

ALAN WOOD STEEL COMPANY

CONSHOHOCKEN, PA.

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I am interested in Iron Powder for:
☐ Molding ☐ Friction ☐ Other
☐ Send literature ☐ Send sample

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COMPANY _____
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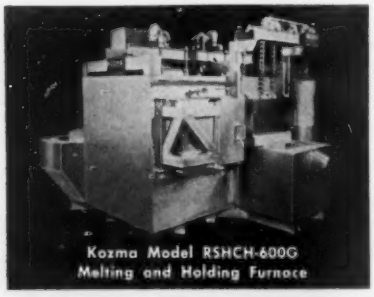
AMERICAN STEELMASTERS FOR 135 YEARS

Circle No. 81 on Reader Service Card

KOZMA
INDUSTRIAL PROCESSING FURNACES
. . . since 1928

THE PERFECT PAIR FOR DIE CASTING

A Kozma Melting and Holding Furnace, in combination with the revolutionary, new Kozma Automatic Ladle, delivers highest quality metal . . . at lowest possible cost.

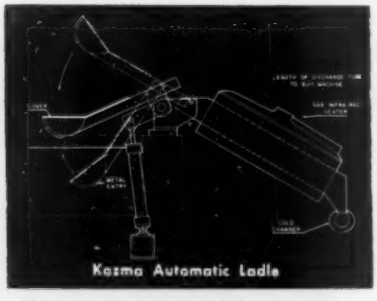


Kozma Model RSHCH-600G
Melting and Holding Furnace

Exclusive Kozma "Pre-Temp" charging and sub-surface metal flow practically eliminates oxygen and hydrogen pick-up and oxide inclusions, keeping metal at high purity level.

Radiant firing provides faster, more uniform heat distribution, eliminates flame impingement and reduces fuel costs.

Kozma Model RSHCH Furnaces range in capacity from 300 to 2,000 lbs. per hour with design variations to meet your requirements.



Kozma Automatic Ladle

The Kozma Automatic Ladle is fast . . . dependable . . . low cost . . . with ½ ounce "shot-to-shot" accuracy. Bottom entry and cover provide sub-surface fill to assure delivery of clean metal to the cold chamber. Will deliver accurately up to 300 shots per hour.

Write today for complete information on improving the quality of your die castings . . . and reducing your costs.

J. A. KOZMA Company
2471 WYOMING
DEARBORN, MICHIGAN

RADIANT FIRED FURNACES UNEQUALLED FOR LOW POROSITY ALUMINUM CASTINGS

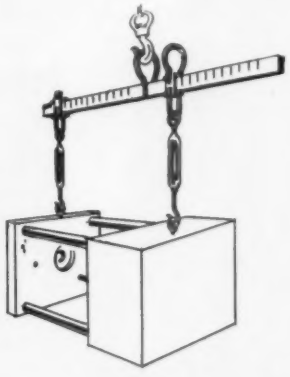
Circle No. **38** on Reader Service Card

new products & developments

Continued

Die handling

JAMES CAPBELL SMITH, INC.—Gonser clamp-on lifting tools lift, transfer, pull, turn over, rotate, and position dies, plates, blocks, castings, etc. They are available in so great a range that they become as indispensable as vises, wrenches and hoists.



Circle No. **252** on Reader Service Card

Metal finishing backstand

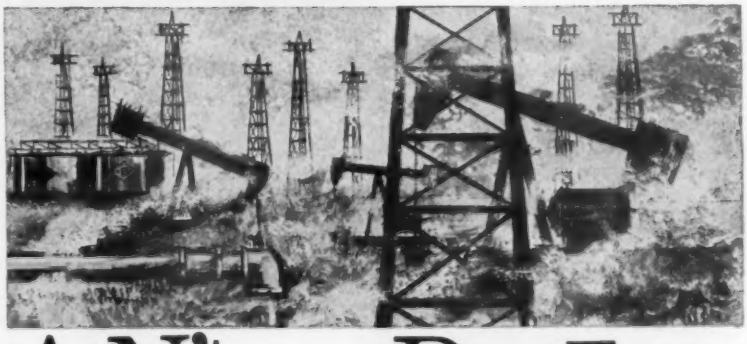
MURRAY-WAY CORP.—This versatile backstand deburrs, squares, grinds and polishes metal parts.

Either 6″ or 12″ abrasive belts can be used. It may be driven by any powered wheel.

Circle No. **253** on Reader Service Card

more New Products on page 74

THERE



AiN't no REST . . .

When the engine has been pounding away day and night . . . week after week . . . and month after month *without* a breakdown, you'll probably find that its essential components are BADGER DIE castings!

BADGER DIE CASTING CORP. 201 W. Oklahoma Avenue, Milwaukee 7, Wisconsin

Circle No. **12** on Reader Service Card

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NOVATE
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brings your attention to its latest achievement

castmatic 2500

the largest in the world!

DIE CASTING MACHINES

oil operated — automatic — fast cycling

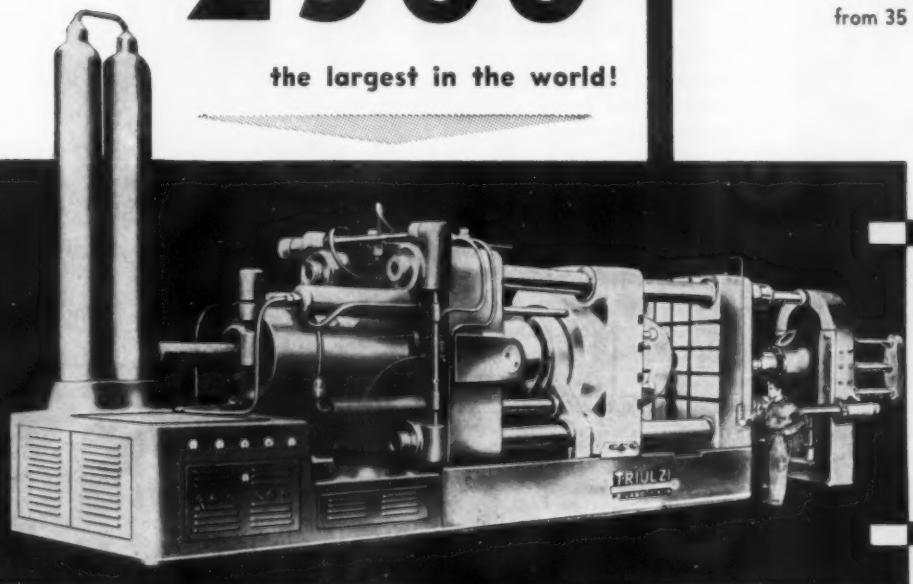
COLD CHAMBER

vertical and horizontal injection

and

HOT CHAMBER

from 35 to 2500 U.S. Tons



cold chamber CASTMATIC 2500
2500 U.S. tons LOCKING FORCE
positive clamping system by blocked piston
weight of the casting (Al. base) up to 130 lbs.

ALL CASTMATIC MACHINES are normally fitted with:

- VICKERS hydraulics
- SIEMENS electrics
- automatic cycle equipment, with PROGRAMME PRE-SELECTING PANEL

and can also be equipped with:

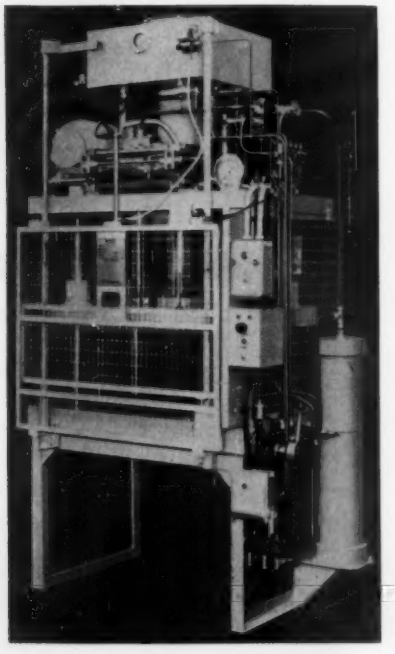
- DOSOMATIC: automatic dosing-filling furnace for cold chamber machines
- VACUUM DIE CASTING device
- AUTOMATIC FORCED LUBRICATION of all mechanical parts
- OVERSIZE WATER HYDRAULIC PLANT for fast cycling
- DEVICE for the automatic control of the oil temperature
- TRIM press, oil operated, fast cycling — for trimming burrs and sprues

OUR STANDARD PRODUCTION:

- deep-drawing presses
- Arbor presses—Extruding presses
- Coining, gauging, hobbing presses
- HIGH PRESSURE HYDRAULIC PUMPS
- INJECTION MOULDING MACHINES FOR PLASTICS
  Models with preplasticizer: from 3 to 705 oz.
  without preplasticizer: from ¾ to 28 oz.
- VERTICAL PRESSES FOR THERMOSETTING MATERIALS
- THERMOFORMING MACHINES FOR THERMO-PLASTIC LAMINATES
- BLOW MOULDING MACHINES FOR PLASTIC HOLLOW ITEMS
- SCREWS AND COMPLETE EXTRUDING PLANTS for making films, rigid and flexible profiles, hollow coatings, plastics coloring and granulation
- PRESSES for POLYESTERS and for PLASTIC LAMINATES
- RECORD MOULDING PRESSES
- SPECIAL PLANTS FOR PROCESSING PLASTICS

Circle No. 73 on Reader Service Card

NEW
BIPEL
FAST-CYCLE
HYDRAULIC
TRIM
PRESS



A brand new 34-ton clipping press from BIPEL... world renowned for their plastic molding presses! This special purpose hydraulic unit offers a faster approach (600 ins./min.), and a fast advance through the work (40 ins./min.), at full tonnage. Dry Cycle Time only 3 seconds. Semi-automatic or manual control... with mesh guards for maximum operator safety. A flexible, efficient, clean-trimming unit.

Write for Full Information

B.I.P. Engineering Ltd., Sutton Coldfield, England

RALPH B. SYMONS ASSOCIATES, INC.
3569 MAIN ROAD, TIVERTON, R. I.

BIPEL

Circle No. **14** on Reader Service Card

new products & developments

Continued

Protective coating

BRADCO PLASTICS, INC.—PlasX-coat protects aluminum and exotic metals plus a variety of other materials. Spray, roll or brush it on. It is available in 20 colors.

Circle No. **254** on Reader Service Card

Spherical powders

LINDE CO.—Spherical powders of 20 to 150 microns in commercially pure ingot iron and zirconium are used to increase flowability in powdered metallurgical compacts.

Circle No. **255** on Reader Service Card

Vacuum diffusion pump

NRC EQUIPMENT CORP.—Model HS 4-750 is a new four-inch franctionating oil diffusion pump. Its advantages are; lower backstreaming, higher fore-pressure tolerance, greater capacity, reliable operation and minimal maintenance.

Circle No. **256** on Reader Service Card

Paint finishing

THE DEVILBISS CO.—A new compact airless pump will handle

all conventional paints when a standard airless gun with medium production caps is used. The pump has a ratio of 26-1 and is good for medium production operations.

Circle No. **257** on Reader Service Card

is
YOUR
PROBLEM

BRASS
?
DIE CASTINGS

Call us now for
complete service
ENGINEERING ASSISTANCE
DIES
PRODUCTION
ZINC • ALUMINUM • BRASS

DIECASTERS, INC.
Closter, New Jersey
Tel. P.O. 8-5400

Circle No. **106** on Reader Service Card

Magnaflake

For Over 20 Years
Manufacturers of
METAL POWDERS
ALUMINUM
BRASS • COPPER
FLAKE, GRAIN AND ATOMIZED FORMS
magna
MANUFACTURING COMPANY, INC.
Plant: HASKELL, NEW JERSEY
TEMPLE 5-1200. CABLE: "MAGNAFLAKE"

Circle No. **46** on Reader Service Card
PRECISION METAL MOLDING

Helpful Hints for Die Casters

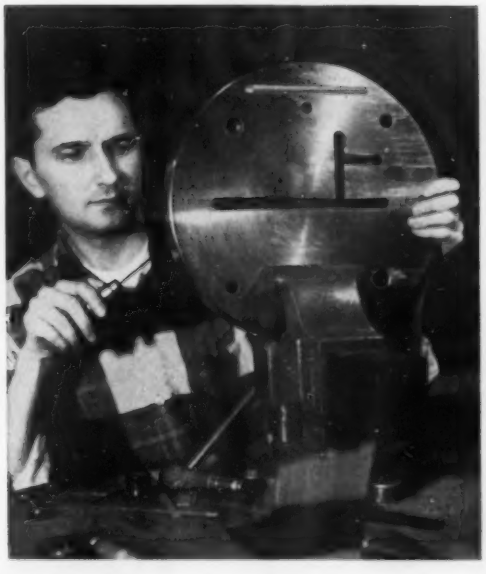
—from Bethlehem's Tool Steel Engineer

Double Tempering Reduces Heat-Checking in Hot-Work Steels

Double tempering has a beneficial effect on the service life of hot-work tools. The initial temper performs three jobs: it relieves quenching stresses, tempers the martensite, and conditions the austenite so that it will transform upon cooling. However, the second tempering operation provides additional benefits because it tempers the freshly formed martensite, giving the steel added strength and stability.

The double tempering of hot-work steels is widely practiced by the toolmaking industry. It reduces the danger of grinding cracks, and minimizes breakage in service.

Double tempering of hot-work steels helps avoid heat checks when a tool is first placed in service. By tempering the martensite, formed when the tool reaches room temperature after the first temper, the second temper minimizes the thermal shock of the initial service operations, and delays the development of heat checks.



Cromo-WV Upset-Forged Discs Wear Well at High Temperatures

Upset-forged discs made of Bethlehem Cromo-WV (H-12) tool steel are ideal for high-temperature extrusion work because of the long service they make possible. Their strength is enhanced by the flow lines generated in upsetting, and the hardness developed by heat-treatment, which is maintained at high operating temperatures. Bethlehem Cromo-WV discs also develop strong resistance to the effects of high-temperature service.

Cromo-WV is a wise choice for extrusions tooling because of its 5 pct chrome content, plus the balanced alloying of molybdenum, tungsten and vanadium. It resists heat-checking, and has good red-hardness, plus the ability to withstand shock applications.

Your Bethlehem tool steel distributor will be pleased to provide full information about upset-forged discs made of Cromo-WV. He can also give you advice concerning their use in specific applications.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

Steel

For Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL

BETHLEHEM STEEL

Circle No. 13 on Reader Service Card

Low-cost answer to hydraulic fluid safety...
UCON Fire-Resistant Hydrolubes

ARE you running the risk of being burned out of business by a sudden hydraulic line break that sprays flammable fluid into a hot and hazardous area?

The dangers of such a fire can be virtually eliminated by converting to fire-resistant UCON hydrolubes. This has been proved by exhaustive field tests and more than 14 years of routine use in industrial hydraulic systems.

UCON hydrolubes are balanced formulations of a water-soluble polyglycol thickener in an ethylene glycol-water base. Selected additives keep pump replacement costs low and provide maximum liquid and vapor-phase corrosion resistance. As long as water content is adequately maintained, UCON hydrolubes give complete protection from flash fires; they also have successfully passed 100 per cent oxygen atmosphere spray flammability tests.

UCON hydrolubes come in viscosity grades to meet all system needs and operating conditions. Their viscosity-temperature properties are better than those of other types of fire-resistant fluids and petroleum oils.

Conversion from flammable petroleum oils or non-aqueous fire-resistant fluids to fire-resistant UCON hydrolubes is quick and easy. No special packings and seals are required. In many instances, leakage loss is reduced.

For complete information on the economy and efficiency of UCON safety hydraulic fluids, and the simple conversion steps for your systems, call your CARBIDE Technical Representative, or write: Union Carbide Chemicals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.

UNION CARBIDE CHEMICALS COMPANY

UNION CARBIDE

UCON and UNION CARBIDE are registered trade marks.

PMM

useful literature, catalogs, manuals *qualified readers may obtain*

any of these technical publications by circling the numbers on the reader service cards.

PROCESSES

150 *Die Casting*—BENDIX FOUNDRIES–Brochure describes economical production of die castings for short or long production runs.

151 *Impact Extrusion*—PRECISION COLD FORGED PRODUCTS CO.–4-page Brochure shows parts available by impact extrusion.

MATERIALS & EQUIPMENT

158 *Lubricants*—ACHESON COLLOIDS CO.–Brochure describes application of colloidal dispersions as lubricants and parting agents. Case history reports tell how dispersions are used in the shop and in extreme temperatures.

159 *Fluxes*—FOUNDRY SERVICES, INC.–Brochure describes fluxes and compounds used for die casting aluminum and magnesium alloys.

160 *Vacuum Equipment*—NRC EQUIPMENT CORP.–Booklet describes new applications of vacuum equipment.

161 *Production Scheduling*—MEMO FLEX DIV.–Booklet describes a bulletin-board-type unit used to simplify production control or scheduling.

162 *Heating Equipment*—IPSEN INDUSTRIES, INC.–Bulletin describes furnaces used for atmosphere tempering, annealing and stress relieving.

163 *Unit Dies*—DETROIT MOLD ENGINEERING CO.–Booklet gives case history of unit die application, includes technical data.

164 *Cutting Tools*—THE CARBORUNDUM CO.–28-page Catalog gives technical data on a complete line of ceramic cutting tools, includes specs and prices for throwaway inserts.

165 *Induction Heating*—LEPEL HIGH FREQUENCY LAB., INC.–Booklet discusses applications, research and production involving induction heating.

166 *pH Meters*—ANALYTICAL MEASUREMENTS, INC.–Literature describes a line of ph meters that include analytical pH probe units.

167 *Heating Equipment Accessories*—SELAS CORP.–8-page Booklet describes a continuous reading instrument which accurately indicates changes in flame characteristics caused by variations in air/gas mixture.

168 *Air Compressors*—CHAMPION PNEUMATIC MACHINERY CO.–16-page Catalog describes line of air compressors, pumps, washers and accessories.

169 *Powder Metals*—THE U.S. GRAPHITE CO.–Quarterly describes applications of graphite products to be used in powder metallurgy.

170 *Tool Steels*—VANADIUM-ALLOYS STEEL CO.–Data Sheets give technical information on several tool steels for dies, molds and rolls.

171 *Carbides*—SINTERCAST DIV.–Catalog tells stock sizes, application case histories, and technical data on carbides for tools and dies.

172 *Stainless Steel Powders*—VANADIUM-ALLOYS STEEL CO.–Data Sheets describe two prealloyed stainless steel powders with high green strength and improved sintering qualities.

173 *Metals*—THE DOW METAL PRODUCTS CO.–Chart lists chemical composition and characteristics of aluminum alloys.

174 *Vacuum Equipment*—VACUUM-ELECTRONICS CORP.–Data Sheet describes air-operated solenoid controlled valves for high vacuum applications.

175 *Investment Casting Cores*—AMERICAN LAVA CORP.–Technical Data Chart on alkali leachable ceramic cores for investment casting plus other related coring data including thermal expansion, dielectric strength and selection chart for various materials.

176 *Tools & Molds*—MORRISON MACHINERY & ENG. CORP.–Brochure gives data on a cross slide rotary table for making die cast dies, tools and patterns.

177 *Metals*—THE H. M. HARPER CO.–24-page Brochure describes how to design corrosion resistance into products. Chart lists 136 corrosive agents.

FINISHING

181 *Plating Equipment*—THE UDYLITE CORP.–Booklet gives technical information on a complete line of electroplating supplies including materials, solutions and compounds.

182 *Metal Cleaners*—MACDERMID INC.–3 Technical Data Sheets describe metal stripping compounds that strip electroless nickel coatings from metals by immersion.

more Useful Literature on page 80

WHY

ARE ZINC DIE CASTINGS *the most widely used* ?

because the ZAMAK alloys have advantages over the other die casting materials...

WHY

has the use of nonferrous metal powders *increased faster than* ferrous powders ?

because HORSE HEAD brass and nickel silver powders have so many outstanding advantages

HORSE HEAD PRODUCTS ®

- . . . bright, lasting finish at low costs
- . . . range of alloys for controlled properties
- . . . closer control of dimensional tolerances
- . . . superior machinability
- . . . excellent corrosion resistance without plating
- . . . wide range of electrical properties
- . . . attractive color

RANGE OF MECHANICAL PROPERTIES

	ZINC ALLOYS	ALUMINUM ALLOYS	MAGNESIUM ALLOYS
Impact Strength	43-48, CHARPY (toughest)	2-8, CHARPY	1-2, IZOD
Tensile Strength	41,000-48,000 (strongest)	30,000-45,000	30,000-33,000
Shearing Strength	31,000-38,000 (toughest)	19,000-28,000	20,000
Elongation	7-10 (most ductile)	2-9	1-3
Brinell Hardness	82-91 (hardest)	50-80	60-62
CASTING CHARACTERISTICS			
Ease, Speed of Casting	(easiest)		
Maximum Feasible Size	(greatest)		
Complexity of Shape	(most complex)		
Dimensional Accuracy	(most accurate)		
Minimum Section Thickness	(thinnest)		
Surface Smoothness	(smoothest)		
COST			
Die Cost*	(lowest)		
Production Cost	(lowest)		
Machining Cost	(next to lowest)		
Finishing Cost**	(lowest)		
Cost per piece***	(lowest)		
EXTENT OF USE			
Extent of Use	(most used)		

*Dies for casting the low melting point alloys are least expensive and have longest life.

**Includes polishing and buffing expense as well as ease of applying all types of commercial finishes, both electrodeposited and organic.

***Based on die and fuel costs, production speed and machining and finishing costs.

NOMINAL RANGE	HORSE HEAD BRASSES	HORSE HEAD NICKEL SILVERS
Copper	70-90%	64%
Nickel	—	18%
Lead	0-1.75%	0-1.5%
Zinc	remainder	remainder
PROPERTIES AND CONSTANTS		
Tensile Strength	23,000-41,000	23,000-31,000
Elongation	8-34	7-15
Rockwell H Hardness	58-81	78-80
Electrical Conductivity	154,000-205,000	32,000

SEND FOR THESE USEFUL BOOKLETS

They will show you in detail how you can apply these cost-saving processes to your prod[illegible] actual case histories and many illustrations of practical application are presented for reference.

THE NEW JERSEY ZINC COMPANY

160 Front Street, New York 38, N. Y. — 221 North LaSalle Street, Chicago 1, Ill.

1 Casting Process is Best For Your Specific Design...

Hampden Brass Offers 4 Different Methods To Choose From!

PERMANENT MOLD
Aluminum Alloys-High Purity Alloys

DIE CASTING
Aluminum Alloys-Zinc

SAND FOUNDRY
Aluminum Alloys-High Purity Alloys
Brass-Bronze-Monel

FIBERGLAS CASTING
High Quality Structural Fiberglas
Modern Vacuum Process

ONLY ONE IS BEST!
Let Hampden Brass's experts help you decide which process best suits your requirements . . . and help you produce a better product at lower cost!

Like to know more about Hampden Brass? Write for Illustrated Brochure, "Behind the Scenes" . . . a complete Digest of Hampden Brass's experience, equipment and facilities.

HB
For Guaranteed Quality . . .
Look to the Diamond of the Industry

Hampden Brass & Aluminum Company
Established 1903
SPRINGFIELD, MASSACHUSETTS

Complete Pattern, Machine, and Die Shops . . .
X-Ray and Laboratory . . . Heat Treat and Wheelabrator facilities

Circle No. 30 on Reader Service Card

useful literature, catalogs, manuals

183 ***Finishing Equipment***—PACKER MACHINE CO.—5 Catalog Sheets list complete specifications on units for automatic buffing and polishing.

184 ***Abrasives***—THE CARBORUNDUM CO.—50-page Catalog gives technical information on national standard abrasive belts, rolls, sheets and discs.

185 ***Barrel Finishing***—NORTON CO.—96-page Book tells A-B-C's of barrel finishing including what it is, abrasives, equipment, compounds and other technical data.

186 ***Paint Spraying***—CONFORMING MATRIX CORP.—Brochure describes electroformed masks for multiple color wet painting of mass produced products.

187 ***Abrasive Sanding***—THE CARBORUNDUM CO.—Brochure describes a new fiber-backed abrasive disc for light grinding operations.

193 ***Grinding Attachment***—DELTA POWER TOOL DIV.—Data on a plane blade grinding attachment for a delta belt and disc finishing machine.

195 ***Electropolish Compound***—MACDERMID INC.—5-page Technical data sheet on a liquid acid electropolish used to remove sharp edges from castings.

196 ***Metal Cleaner***—E. F. HOUGHTON & CO.—Data Sheet describes a liquid that removes rust and gives iron phosphate coating.

197 ***Fasteners***—PARKER-KALON—Catalog Unit gives technical data on a complete line of thread cutting screws.

198 ***Metal Finishing Equipment***—THE MEAKER CO.—29-page Guide describes a wide range of machines and equipment designed to automate metal finishing, includes technical data on metals.

199 ***Buffing***—DIVINE BROTHERS CO.—Catalog Sheet lists sizes and specifications of a complete line of bias-type buffs.

200 ***Polishing***—THE CARBORUNDUM CO.—Folder tells of new polishing rolls for lapping crankshafts and bearings.

201 ***Metal Finishing***—MACDERMID INC.—Technical Data Sheet lists full range of aluminum finishing processes and compounds including anodizing, barrel finishing, electropolishing, deburring and plating.

202 ***Metal Spraying***—SPRAYING SYSTEMS CO.—Bulletin describes a complete line of spray nozzles and accessories for washing, rinsing, fogging or coating parts.

203 ***Protective Coating***—PENNSALT CHEMICALS CORP.—Leaflet describes the Hinac Process for chromate surface treatment for all metals.

Now you can melt this

ALUMINUM SCRAP

(Dealers' buying price f.o.b. New York in cents per pound)

Alum. pistons and struts	6½ — 7
Aluminum crankcase	8½ — 9
1100 (3s) aluminum clippings	11½ — 12
Borings and turnings	8½ — 9
Industrial castings	4½ — 5
2020 (24s) clippings	9 — 9½
	10

ALUMINUM INGOT

(Cents per lb del'd 30,000 lb and over)

95-5 aluminum-silicon alloys	
0.30 copper max.	24.25-24.50
0.60 copper max.	24.00-24.25
Piston alloys (No. 132 type)	26.00-27.00
No. 12 alum. (No. 2 grade)	22.75-23.25
108 alloy	23.25-23.75
195 alloy	25.75-26.75
13 alloy (0.60 copper max.)	24.00-24.25
AXS-679 (1 pct zinc)	23.00-24.00

(Effective Mar. 13, 1961)

...instead of this

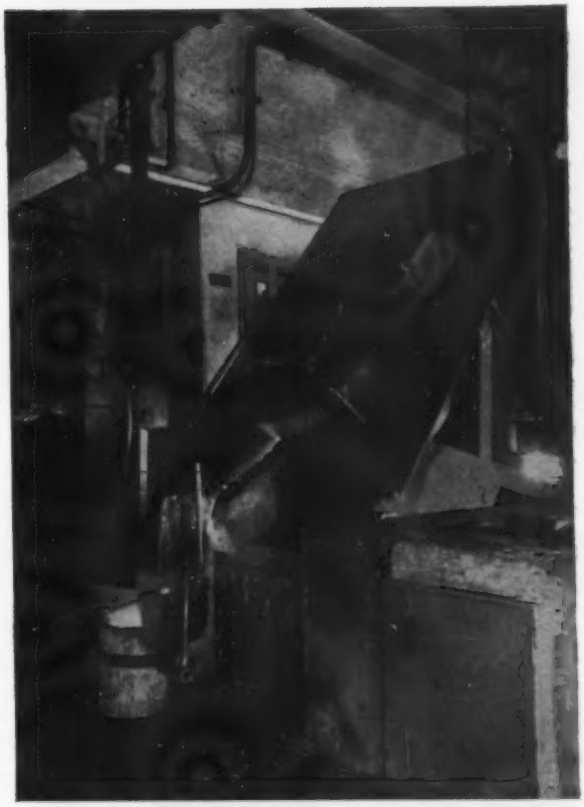
The Brown Boveri coreless line-frequency induction furnace obsoletes fuel-fired furnaces for melting aluminum... offers lower overall melting and operating costs, superior metal, cleaner working conditions.

Here in perfected form from the world's most experienced builder of induction heating equipment is a furnace that makes it *practical and profitable* for you to melt light, bulky aluminum scrap which cannot be used in a fuel-fired furnace because of prohibitive metal losses. *Average losses certified by customer for long-term operation of 8 furnaces melting ingot, chips and machining scrap for aluminum auto parts: 3% based on weight of finished castings compared to weight of metal charged to furnaces!* Losses are even lower when melting ingot and heavy scrap – less than 1% as compared to 7% and higher in fuel-fired furnaces.

Other bonus features that are making this furnace the talk of the aluminum casting industry:

- Higher grade, more uniform metal through precise temperature control and natural stirring action. Highest output per unit – up to 19,000 lbs. per hour.
- Fast alloy changes. Furnace can be emptied and restarted with a cold charge. Uses substantially less flux.
- Clean, cool operating conditions. Virtually no fumes.
- You ram the crucible more easily; less curing time.
- Simple, foolproof design–easy to operate and maintain. One man operates several units. Uniquely suited to full automation.
- No clogging or cleaning of channels with this *coreless* design. No danger from metal freeze-ups and no need to hold heat between shifts and over weekends.

Get the whole story. Learn how this furnace can pay for itself while giving you better metal and better castings. Write today to Brown Boveri Corp., Dept. F5, 19 Rector St., New York 6, N. Y.



Above: a 360-KW Brown Boveri furnace for aluminum with melting rate of 1350 lbs./hr. Hydraulic tilting mechanism provides safety and precise control. Brown Boveri makes a full line of line, medium and high frequency induction heating equipment to assure the perfect mating of equipment to every metal and every application.

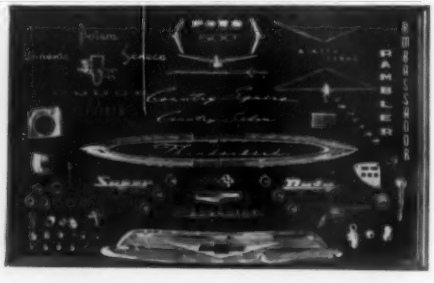
BROWN BOVERI

Circle No. 105 on Reader Service Card

50 million castings a year

PUTTING THE NEW CARS IN TRIM FOR READY SALES

At the TRILEX CORPORATION, Wayne, Mich., this efficient battery of 14 KUX Hot Chamber Die Casting Machines (400- and 600-ton) is part of the complete Trilex facilities for modern die casting, fully automatic plating, finishing, and assembling.



from these KUX die casting machines

"THE PRIMARY concern of the major automobile manufacturers for die-cast trim parts is *quality*," says John Airey, president of Trilex Corporation, important suppliers in the automotive and appliance field. "That's why we have use KUX Die Casting Machines since 1945. They produce hardware finish quality castings.

"But along with quality," Mr. Airey continues, "auto makers as well as appliance men consider *price*. We've found that KUX machines can be depended on for minimum maintenance and minimum downtime. They put us in a better position to compete on a cost-per-unit basis."

Whether your main concern is lower production costs, higher quality or both, investigate the advantages of KUX Die Casting Machines. 28 all-new strain gauge proven KUX models, 50 to 2000 tons, for both hot or cold chamber operation, available with automatic cycling mechanism and KUX patented "Vac-U-Die" and "Auto Feed" systems of vacuum die casting.

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

KUX MACHINE CO.

6725 North Ridge Avenue, Chicago 26, Illinois

Circle No. **39** on Reader Service Card

data offered in this month's ads *qualified readers may obtain any of these free reference materials by circling the numbers on the reader service cards*

1. **Burnishing Media** — The Abbott Ball Co. — Bulletin tells how a burnishing media produces a long lasting polished finish.
2. **Die Casting** — Advance Tool And Die Casting Co. — Folder describes cost reduction advantages of certified zinc and aluminum die castings.
5. **Die Casting Alloys** — Apex Smelting Co. — Booklet describes composition, properties and other data on die casting alloys.
6. **Investment Casting** — Arwood Corp. — 48-page Book tells how to design for the process, gives complete tables on properties.
10. **Die Casting Machines** — B & T Machinery Co. — Information on a die casting machine with a superior hydraulic system.
11. **Trim Press** — B & T Machinery Co. — Information on a 2-bar hydraulic trim press.
14. **Trim Press** — B.I.P. Engineering Ltd. — technical Data on a 34-ton, hydraulic trim press.
21. **Standard Unit Dies** — Detroit Mold Engineering Co. — technical Brochure tells how to lower die costs through standardization.
22. **Die Casting** — Dollin Corp. — facilities Brochure shows equipment and services available for die casting.
24. **Hot Die Lubricant** — Fiske Brothers Refining Co. — Information on hot die lubricants for extrusion.
26. **Tiny Zinc Die Castings** — Gries Reproducer Corp. — Booklet includes designer's check list for small zinc die castings.
27. **Crucibles** — Denver Fire Clay Co. — Catalog gives full information on a line of crucibles and funnels.
30. **Castings** — Hampden Brass & Aluminum Co. — Brochure shows equipment and services for permanent mold and die casting.
31. **Refractories** — Harbison-Walker Refractories Co. & Subsidiaries — Test data and product descriptions show resistance of refractories to aluminum alloy reaction.
32. **Investment Casting** — Hitchiner Mfg. Co. — technical Information on the ceramic shell method of investment casting.
34. **Hydraulic Fluids & Packings** — E. F. Houghton & Co. — Table describes packing-fluid compatibility for hydraulic systems.
38. **Melting Equipment** — J. A. Kozma Co. — Technical information on a melting and hold furnace and new automatic ladle for die casting.
39. **Die Casting Machines** — Kux Machine Co. — Catalog describes a line of 28 die casting machines.
41. **Die Casting Machines** — Lester-Phoenix, Inc. — Bulletin 102 tells how to get better parts with the Certified Clamp on die casting machines.
45. **Die Casting** — Madison Kipp Corp. — 24-page Book shows die casting problems solved and gives information on other products.
54. **Alloys & Powders** — The New Jersey Zinc Co. — Booklets give design information for zinc die casting alloys and brass and nickel silver powders.
55. **Die Casting** — Newton-New Haven Co. — Folder for designers and product planners explains the PDCS process for die casting.
57. **Die Castings** — Paramount Die Casting Co. — Brochure tells how to design for die casting.
58. **Permanent Mold Casting** — Permanent Mold Die Co. — Brochure describes the direct chill mold casting process.
59. **Lubricating Equipment** — Pierce-Waller, Inc. — Information on a system for lubricating, cleaning and cooling molds.
61. **Trim Presses** — Parker-Hannifin Corp. — Bulletin describes high speed hydraulic trim presses.
66. **Powder Metallurgy** — Reese Metal Products Corp. — Booklet tells how to cut costs by the Remet process.
72. **Pots** — The Tiffin Foundry Inc. — Brochure lists a complete line of stock pots and die casting machine accessories.
75. **Tool Steels** — Uddeholm Co. of America — Technical information on tool steels for die casting and extrusion.
76. **Hydraulic Fluids** — Union Carbide Chemicals Co. — Information on Ucon safety hydraulic fluids.
77. **Die Steels** — Vanadium-Alloys Steel Co. — Technical and application data on die casting and mold steels.
79. **Non-Ferrous Metals** — Hyman Viener & Sons — Chart of metal specifications for non-ferrous metals.
81. **Iron Powders** — Alan Wood Steel Co. — Literature on custom blended iron powders.

90-102. Investment Casting—Misco Precision Casting Co. — Technical bulletin on investment casting. See ad page 6 for individual listings.

105. **Induction Furnace** — Brown Boveri Corp. — Technical information on a coreless line-frequency induction furnace.
109. **Die Blocks** — Richards Tool & Mold Co. — Catalog Sheet describes cost-savings on unit die blocks and ejector plates.

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

51. **Fire Resistant Hydraulic Fluids** — Monsanto Chemical Co. — Bulletins describe how to prevent fire in die casting machines, with the right hydraulic fluid.
56. **Machine Tools** — Onsrud Machine Works, Inc. — Catalog gives information on a complete line of mach speed tools, also other tools for non-ferrous metal parts.
106. **Die Casting** — Diecasters, Inc. — Complete service for die casting parts in zinc, aluminum and brass.
107. **Metal Powders** — Guardian Chemical Corp., United International Research, Inc. — Offers pure, air-stable titanium metal powders.

news of industry & associations

Continued from page 15

The Carborundum Co.—*Dr. John E. Niesse* has been promoted to manager of the Research and Development Div. Process Development department. *William R. Benn* has been appointed manager of the Market Development Department of the same division.

H-P-M Div., Koehring Co.—A company operated sales and service headquarters has been established in Worcester, Mass. *F. D. Barrick*, sales, and *Robert Wirick*, service, will staff the office.

The Dow Chemical Co.—A new Metals Department for magnesium and other primary metals has been announced. *W. J. Rave* has been named manager and *Hilary A. Humble* sales manager.

RAVE

HUMBLE

The Society of Die Casting Engineers—Officers elected for 1961 are as follows: President, *John L. MacLaren*, Detroit sales engineer for Aluminum Ltd. Sales, Inc.; Vice-President, *Earle W. Bearwin*, chief product engineer, die casting machines, Reed-Prentice Div., Package Machinery Co.; Secretary, *M. R. Tenenbaum*, Detroit sales engineer, Lester-Phoenix Inc.; and Treasurer, *Lee G. Axford*, manufacturing engineer, Ford Motor Co.

Metal Powder Industries Federation—Election to corporate membership of several companies has been announced. For the In-Plant Powder Metallurgy Association, *Purolator Products, Inc.* and *The Clevite Corp., Mechanical Research Div.* For the Metal Powder Producers Association, *Baudier & Fils*, France. For the Powder Metallurgy Parts Manufacturers Association; *Sintered Products Ltd.*, England; *La Metallurgie Francaise des Poudres*, France; and *Sinterisa-Sinterizacao de Metais Ltda*, Brazil.

American Society for Metals—Four staff directors have been appointed: *Ernest E. Thum*, director of editorial services; *A. P. Ford*, director of communications; and *Albert L. Lloyd*, director of administrative services and finance. *Ted C. DuMond* has been confirmed as one of the four key staff directors.

American Zinc Institute—*Mahlon E. Wood* has been named market development engineer. His functions will include technical and educational activities related to the expansion of existing markets and the development of new uses for zinc in all forms.

Crucible Steel Co. of America—*Josef H. Buerger, Jr.* has been appointed director of sales, *Robert M. Simpson* as assistant director of sales, and *G. W. Snyder* as assistant to the vice-president, Commercial and Director of production control.

BUERGER

SNYDER

SIMPSON

The Bendix Corp.—*Dr. Leland I. Doan*, president of The Dow Chemical Co., has been elected a director of Bendix.

The H. M. Harper Co.—Management changes for newly acquired **Anti-**

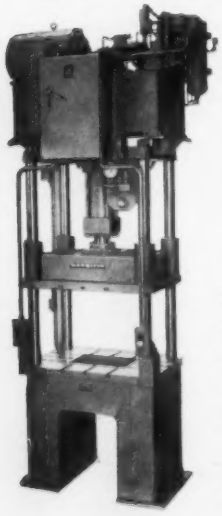
HANNIFIN

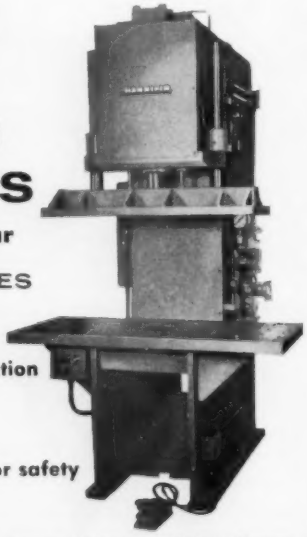
HYDRAULIC

DIE CASTING TRIM PRESSES

Give you more parts per hour

OPEN GAP OR COLUMN TYPES





- High speed operation
- Easier set-up
- Longer die life
- Complete operator safety
- 2 to 150 tons

Faster Speeds • Lower Prices • Quick Delivery

YOU GET THESE FEATURES:

1. Safe, dual electric (or hand) controls
2. Automatic reverse on pressure or distance (adjustable)
3. Adjustable ram pressure
4. Extra-large tables standard
5. All-steel welded and stress-relieved construction
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Corrosive Metal Products Co. include *Earle A. Channer* who has been elected president of the new acquisition, and *H. M. Harper, Jr.* who has been elected vice president and assistant secretary. *Frank J. Legnard* and *John W. Manning* will remain as vice president-treasurer and secretary, respectively.

J. T. Slocomb Co.—New distributors have been appointed. They are: *Enco Supply Co.*, Springfield, Mass.; and *The Ellsworth Industrial Supply Co.*, Stratford, Conn.

Gorham Electronics—Two new manufacturers representatives have been appointed: *Avionics Liaison, Inc.* in Seattle, Washington; and *I. S. Broski*, Winston-Salem, North Carolina.

Oberdorfer Foundries, Inc.—*Vincent D. Bates* has been named factory manager.

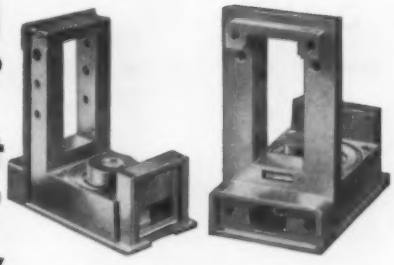
Newark Die Hobbing and Casting Co.—*Nick S. Metrocavich* has been promoted to supervisor of sales and engineering.

Bohn Aluminum & Brass Corp.—*James R. Dissette* has been named manager of Plant #12, South Haven, Mich., succeeding *Edward N. Harris*, who was recently elected vice president sales.

more Industry News on next page

Circle No. 49 on Reader Service Card

Dimensional Accuracy? YES... but Other 'Specs' are Equally Exacting!



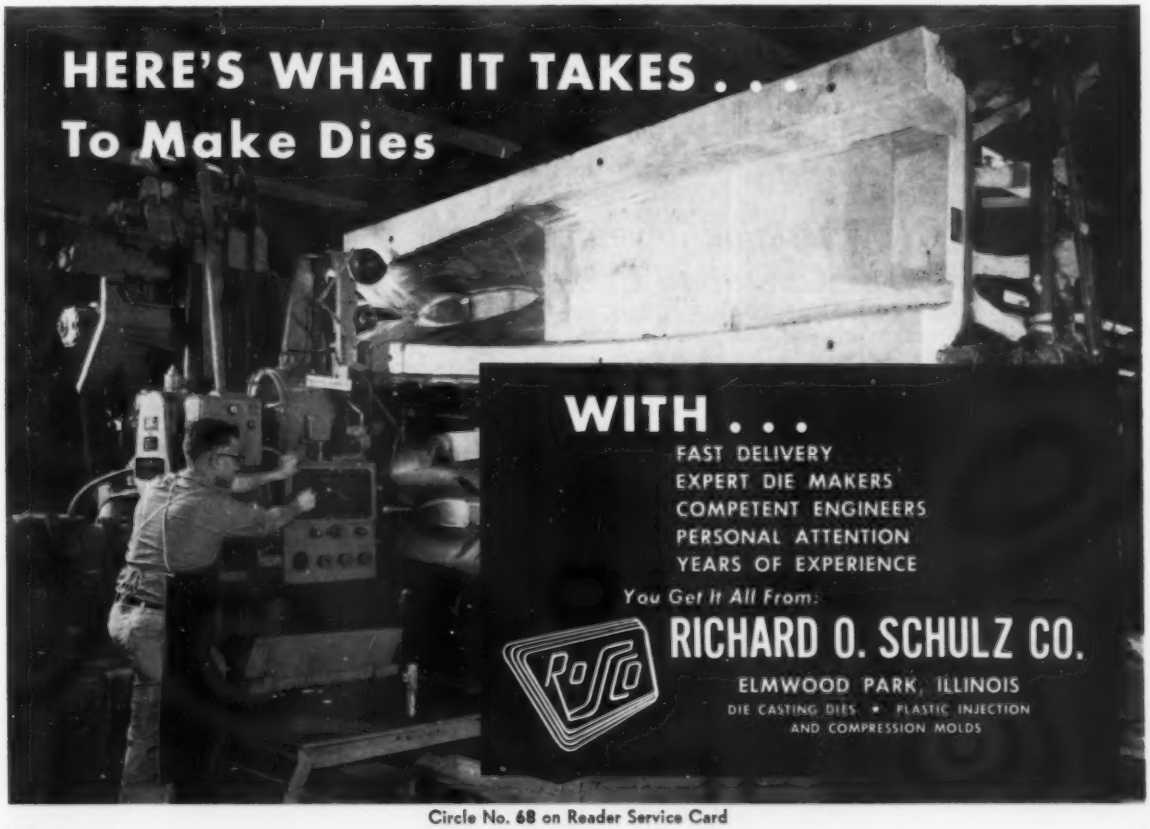
Two views of zinc die-cast body for Air Controlled Timing Valve.

In addition to exacting dimensional tolerances, users of die castings often require other equally precise specifications to be met. For example, in the zinc die-cast body for the Air Controlled Timing Valve pictured, the following requirements were specified to insure successful assembly and functioning: absolute *solidity* and *high density* of the zinc alloy to prevent air leakage — along with a cast-in diaphragm surface absolutely smooth and free from imperfections; bottom of rectangular hole free from burrs; all plane surfaces flat and either parallel or square to one another.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

Milwaukee has been meeting exacting requirements like these for more than a half century!

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909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ON UNIT DIE BLOCKS AND EJECTOR PLATES

And we're talking about H-13 type steel — with even greater savings on other types! How can Richards Tool and Mold give you these big savings? The unit cavity block shown at right is your answer. A Richards cavity block (used with a Richards Master Mold) gives you practically 100% productive area. Compare this with any other unit die block with far less usable area per square inch and the waste of high price metal on the outer edges.

These Richards advantages plus exceptional simplicity of design — mean quotations 35% or more below those on unit die blocks now available!

Richards cost-saving method is fully covered in a special catalog sheet. Write today for your free copy — or give us a call.

RICHARDS
TOOL & MOLD CO.
2715 Lathrop Avenue • Racine, Wisconsin

Typical Richards cavity craftsmanship. Note full use of productive area.

news of industry & associations

Continued from page 15

Kaiser and Kawneer merge

Kaiser Aluminum & Chemical Corp. and Kawneer Co. announced agreement on a merger. The Board of Directors of both companies have approved the agreement and it will be submitted to the stockholders in the near future, it was reported.

Kaiser Aluminum is a major producer of primary aluminum. Kawneer's principal business is manufacturing aluminum architectural products.

Foseco, Inc. is the new name

Foundry Services, Inc., a Cleveland producer of metal treating compounds, has adopted the new name Foseco, Inc. The new name incorporates the company's trademark "Foseco". Company President, David T.

NEW GREENLEE-B&T 2-BAR HYDRAULIC TRIM PRESS

- *Low Original Investment*
- *Low Operating Costs*

Designed for handling the variety of smaller and medium size trimming jobs encountered in all types of shops. Extremely fast. Large die space area. Provides easy access for loading and unloading.

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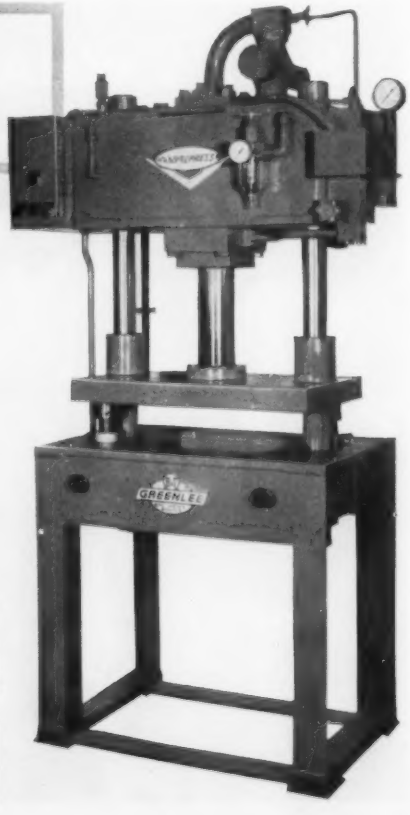
GREENLEE-B&T HOT AND COLD CHAMBER DIE CASTING MACHINES-125 TO 2500 TONS

PRODUCTION MACHINERY GREENLEE B&T



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DIE CASTING MACHINES • COMMERCIAL CASTINGS

Circle 11 on Reader Service Card

Morgenthaler, explained that the old name implied they only served the foundry industry instead of all metal pouring industries.

Stokes starts subsidiary in Great Britain

F. J. Stokes Corp. has established a subsidiary company in Great Britain. It has been named F. J. Stokes Limited and has headquarters in London. The company will market to British and European manufacturers, automatic plastics molding equipment and other high-speed automatic machinery.

Cast-Master will relocate

Cast-Master, a department of Koehring Co.'s H-P-M Div., will move its entire manufacturing and administrative operations from its present location in Bedford, Ohio to H-P-M facilities in Mt. Gilead, Ohio. Plans call for completing the move by July 1, 1961.

ASA group to tackle standards problems

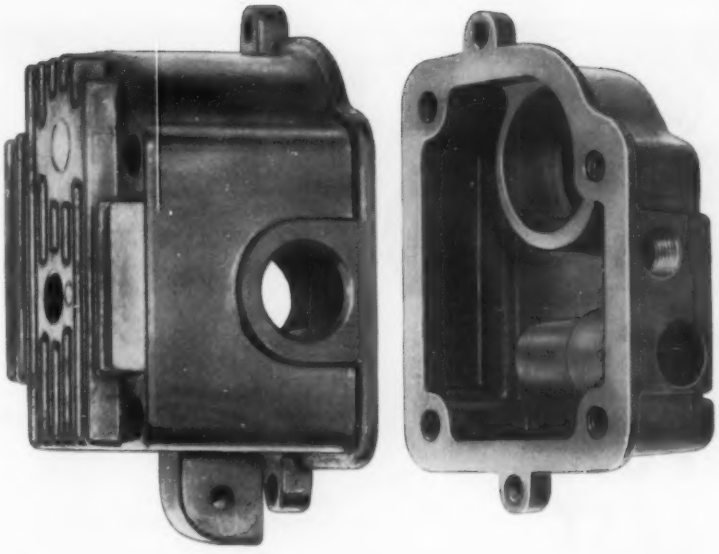
Standardization problems confronting industry will be discussed at the annual spring meeting of the Company Member Conference of the American Standards Association. The meeting is on June 1-2 and will be held in Chicago. More information is available from ASA, 10 East 40th St., New York 16, N.Y.

Die Casting Exposition to be in Detroit in 1962

The Second National Die Casting Exposition & Congress will be held in Detroit's Cobo Hall from September 25-28, 1962, according to an announcement from The Society of Die Casting Engineers. The Exposition is expected to attract 150 exhibitors and occupy a 40,000-sq. ft. floor space. Attendance is expected to be 7,500.

Selection of Detroit as the site for the second Exposition is the result of a survey of the exhibitors in the first Exposition.

more Industry News on next page



Which came first, the process or the part?

When you see a die casting like this you just about have to ask yourself . . . "Did the production process make the part possible, or did design dictate the process?"

Part-wise this gear box demands precision, strength, heat dissipation, maximum elimination of post-casting machining. It is integral and functional to the power mower for which it was built. Did design dictate die casting?

Process-wise, the shape couldn't have existed with such close tolerances, with such variable shapes without die casting. No known method of parts production could produce the part at such low unit cost and maintain requirements.

Perhaps this is the way to look at it: Good part design and good die casting *combine* for superior results. Since 1919, Twin City Die Castings has aimed its complete plant facilities to achieve this end.

. . . only DIE CASTING can

✔ cut your costs ✔ offer such flexibility ✔ provide such accuracy

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news of industry & associations

Continued

Fastener maker bought by Harper

The H. M. Harper Co. has acquired Anti-Corrosive Metal Products Co. of Castleton-On-Hudson, N.Y. The newly acquired firm is in the same business as Harper, specializing in the manufacture and distribution of stainless steel industrial fasteners.

Sutton press means greater production

A new Sutton 1650-ton extrusion press, installed at the Greater Louisville Industries plant at Jefferson, Indiana, is setting new high production records for extruded solid and hollow aluminum shapes. A week after delivery, the press was said to be extruding up to 5000 lb. per hour. It is a horizontal extrusion press equipped with Sutton-pioneered electronic servo controls for fully automatic operation. An auxiliary control panel mounted on the front platen makes possible operator control of all functions.

50,000 psi tensile strengths with Reynolds Tens-50

Aluminum castings with tensile strengths up to 50,000 psi may be made under normal foundry conditions through use of a new Reynolds Metals Co. alloy. It is designated Tens-50.

The new alloy was developed for use in critically loaded aircraft and missile structures by the Los Angeles Div. of North American Aviation. The principle alloying elements are silicon and magnesium with small additions of beryllium.

Deeper look into abrasive machining

Abrasive machining is the subject of an intensive research

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PRECISION METAL MOLDING

project now in progress at Norton Co. The results of this study are expected to show that machining of castings and cut-off steel stock to final finish dimensions can be economically accomplished entirely with abrasive products.

The first phase of the Norton project is the correlation of available information from all sources.

Initial findings indicate that the greatest potential savings in the use of abrasive machining may be in the fields of flat surface machining and in slotting and grooving applications because of the suitability of presently available equipment.

Lord Chemical joins Wheelabrator

The Lord Chemical Corp. is now known as the Lord Chemical and Equipment Division of Wheelabrator Corp. The Lord division will continue to manufacture finishing equipment, media and compounds.

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5th in a series of POWDERED METAL PARTS applications by REESE

Powdered Metals . . .

NEW WAY TO MAKE PADLOCKS

By-passing castings and extrusions, the major parts of this brass padlock for the government are made of Reese powdered metal parts. Higher precision and lower cost result by designing the lock to take full advantage of the powder metal process. All parts meet government specs MIL-B-12128A.

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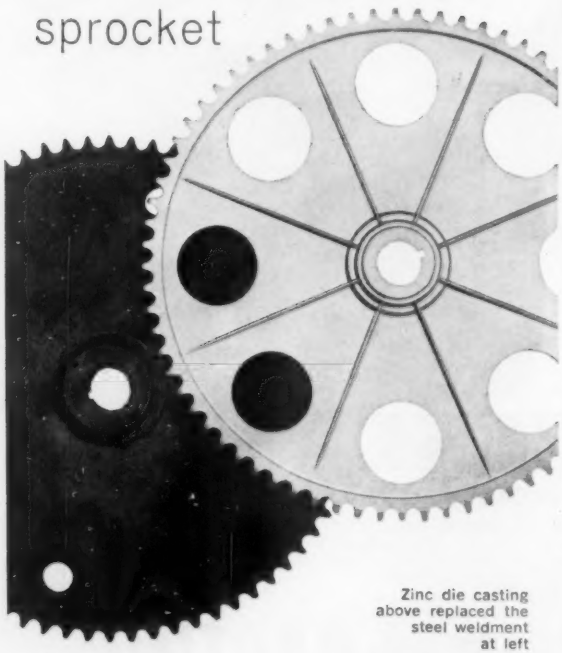
ADVANCE put
teeth *
into reducing
the cost of this
sprocket



Zinc die casting above replaced the steel weldment at left

*
By "teeth" we mean Advance engineers bit deep into the cost of the 12-inch steel weldment sprocket shown above and came up with a **saving of better than 50%** in converting it to a zinc alloy die casting.

The sprocket drives the rotating drum of an industrial clothes dryer. Both pitch and O.D. are held to .010 tolerance. Interchangeable cores and inserts readily produce this sprocket with ¾ or 1 inch bore.

Whether it's a conversion, or a die casting of completely new design, putting "teeth" into a die casting cost problem is what Advance engineers like most to do.

Why not send your next print to Advance for a quotation? Ask for the Advance folder "Your Doorway to Certified Zinc and Aluminum Die Castings".

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards.

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serving industry since 1920
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SPECIFY DIE CASTINGS

Continued

Of course, we have to look at the problem from the client's point of view. In his shop it may ultimately cost less to use the die casting.

On the redesign of an existing product, how often do you find that the original has been greatly over-designed? That is, how often is a part hogged out of steel which could better be an aluminum or zinc die casting?

This is a very frequent thing. Many products have just grown from a piece of equipment put together in the tool room. Finally, when the product has become an integral part of a company's line they come to us for redesign. It's at this stage we find heavy steel brackets which we redesign for die casting; housings made of welded sheet steel which should be die cast; and the general styling of the equipment needs cleaning up.

On redesign, we generally look the product over, then disregard present methods of fabrication and redesign in favor of lower cost methods, lighter weight and more efficient assembly.

We also find cases where a product was designed some five or six years ago and has been manufactured without much thought to methods and new developments. Improvements which have come about since the original design work may now make die casting of components most economical.

Do you have many applications where die castings must be joined by welding or brazing?

No. We feel that hand welding and brazing are not high production fabricating methods. However, automatic welding and furnace brazing may be another story. If two die castings have to be brazed together or a die casting brazed to a part made by some other method, it is our feeling that the basic design is wrong. We class hand brazing in the joining field along with sand casting in the fabricating field—that is, low production techniques.

Does this same thinking apply to the use of adhesives for joining metal parts?

Probably not. We believe that the use of adhesives is in the same state that plastics were 20 years ago. The big feature in favor of adhesives is the ability to join dissimilar metals as well as metals to non-metals. This is a fast growing field about which more information is badly needed.

How about some of the stress analysis techniques? Do you use any?

When ever we are in doubt about the strength of a part we have a stress analysis run by a laboratory. In case the stress analysis shows points of weakness we redesign. Probably the wider use of the different methods of stress analysis will lead to the use of die castings in fields where we are now afraid to use them. This could open entirely new fields to die casting.

PMM

book reviews

Atomic Theory for Students of Metallurgy, *William Hume-Rothery; The Institute of Metals. London,* 1960. 427 *pages.* $7.50

• • •

Those wanting to know more about the atomic theory relating to metallurgy will find this book extremely interesting. Discussions, beginning on a fundamental plane, explain the behavior and interactions of molecular, atomic, and sub-atomic particles.

The book is comprehensive, covering subjects ranging from the special meaning of velocity in wave mechanics, to the experimental determination of the electron structure of metals.

With the advances in nuclear physics and the science of semiconductors, this edition up-dates the first edition published fifteen years ago.

The author holds the Isaac Wolfson Chair of Metallurgy at Oxford University.

Nondestructive Testing, *Warren J. McGonnagle; McGraw-Hill Book Company, Inc. New York, 1961. 457 pages. $15.00*

• • •

The theory and application of nondestructive testing is given comprehensive coverage in this clearly written, amply illustrated book. Nondestructive testing is defined as those testing methods which do not impair a material's usefulness.

Since most nondestructive methods involve technology based on applied physics, physical principles and theory are stressed. The advantages and limitations of the various nondestructive testing techniques are covered. Special techniques for solving a variety of practical problems are included.

The author points out that this type of testing is not limited to the detection and location of flaws. It also can be used to measure physical properties.

more Book Reviews on next page

because we're more than the name implied... Foundry Services, Inc. has changed its name to

FOSECO, INC.

We feel that the new name, already well established in the metal-pouring industry, more nearly encompasses our full range of services—to steel mills, to smelters, to wrought metal producers, as well as to foundries.

In making the change, we become even more closely identified with our Foseco product line, a symbol of quality throughout the industry.

Please refer to us as FOSECO, INC. after March 31. And continue to look to FOSECO INC. for new product development, expanded metallurgical research and competent technical assistance with any metal-pouring problem.

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PMM

book reviews

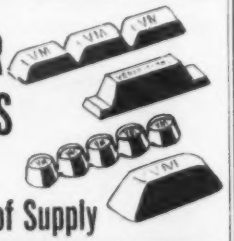
Metals Handbook, 8th edition, Vol. 1—Properties and Selection of Metals, *Metals Handbook Committee; American Society for Metals. Novelty, Ohio, 1961. 1300 pages. $30.00*

° ° °

Sometimes property data and reference tables aren't enough to give the engineer an understanding of economical metals selection. He often needs authoritative reports and opinions by men intimately associated with the field. This handbook is especially useful since it provides both the technical data and first-hand reports.

This doesn't mean the user has to wade through descriptive text to get at essential information. Emphasis is still placed on numerical information in the form of charts, graphs, and tables. A large number of specific examples and comparisons makes it easy to use.

VIENER METALS



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opportunities

jobs and equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Road, Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITION OPEN

DIE CASTING SUPERVISOR—Experienced man required to manage shop with three zinc machines. Must have knowledge of die design, gating and venting, die and machine repair. Prior supervisory experience helpful, but not necessary. Excellent opportunity in town of 25,000 located 300 miles from Chicago. We are not seeking a college graduate but a practical, shop-experienced man. Reply to Box 5161.

INVESTMENT CASTING SALESMAN—Nationally-operating investment casting company seeks direct employees to sell in California and Arizona. Residence area will be Los Angeles or vicinity.

Benefits are exceptional, including participation in profits, a company-supplied car, and many others.

Background and experience in investment casting sales is critical. Knowledge of engineering, metallurgy, etc., is highly desired, as is knowledge of and association with aircraft and related companies.

Candidates should state background, income desired, date of availability for employment, and any other items of interest, in their response.

This is a permanent, full-time job. Please address replies to Box 3261. All replies will be held confidential.

SALESMAN—Experienced in selling Zinc and Al. Die Castings for reputable Chicago based firm, areas cover Indiana, & Illinois including Chicago. Complete reference necessary. Reply Box 5261.

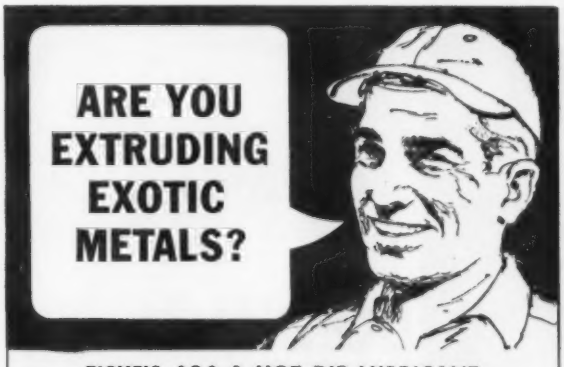
DIE CASTING SUPERINTENDENT—For subsidiary of large corporation located in the east. Must have supervisory experience. Send qualifications and salary required in first letter. Box 5361.

REPRESENTATIVES WANTED—For Midwest producer of Aluminum Permanent Mold castings. Foundry has machine shop and can furnish castings machined complete. Areas open: N. Ohio, W. Pa., Detroit, S. Mich., Ill., & Ind. Box 5461.

DIE CASTING Shop Foreman Aluminum and Zinc to train operators and supervise five (5) Zinc machines. Cast-Master 150 ton and two 500 ton Cold Chambers. Opportunity for advancement. Salary commensurate with ability. Location—Maryland's Eastern Shore. Apply to Box 2414, Cambridge, Maryland.

EQUIPMENT

FOR SALE—50 Die Casting Machines—Used—thruout USA. Send for list. Lake Erie 300 ton (4) Zinc, some rebuilt. WANTED—machines to list, also to rebuild for resale or use.
Fred C. Ziesenheim M.E., 523 King Ave., Marion, Ohio.



FISKE'S 604-A HOT DIE LUBRICANT
FISKE'S BMI-4 HOT DIE LUBRICANT

Successfully used for extruding in the 1500°—2300° temperature range. Recommended for working titanium, zirconium, molybdenum, copper, regular and naval brass and bronze.

FISKE'S 514-A HOT DIE LUBRICANT

A graphited lubricant for forging, upsetting, extruding and forming brass, copper, aluminum and steels including stainless steels.

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FISKE'S SINCE 1810

METAL WORKING LUBRICANTS

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Plants: Newark 5, N. J. and Toledo 5, Ohio

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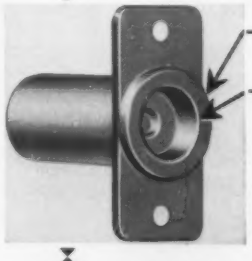
Close Tolerance Pieces ... Need Not Be Costly

Peasley Products, Inc. has accepted the challenge of the design engineers and produces high precision die castings as illustrated below at low costs.



Concentricity of above dimensions .0005"

Piece Illustrated Die Cast in Zamak 3

This is just one example of Peasley's know-how. Contact Peasley before your next Die Casting job.

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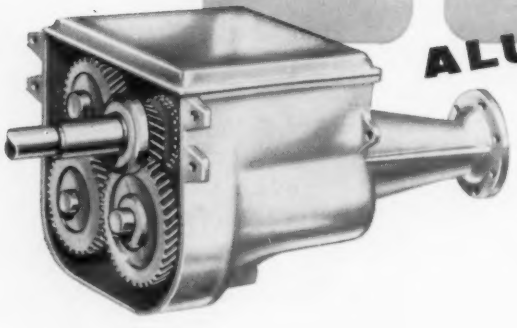

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